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Fire resistance of SNAP Multiple Services Retrofit Collar (MS70R) when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005

Assessment Report

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Copyright and disclaimer

Important disclaimer

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1 Introduction

This report is an assessment of fire resistance of various SNAP Multiple Services Retrofit Collar (MS70R) when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

This report is prepared for meeting the evidence of suitability requirements of NCC Vol 1 Schedule 5 clause 2(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 Section 7, 8 and 9.

2 Supporting Data

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

Table 1: Reference test data

Report Reference	Test Standard	Outline of Test Specimen
FSP 1990	AS 1530.4 - 2014	A fire resistance testing of an 1160-mm x 1160-mm x 116-mm thick wall penetrated by two (2) pipes protected by retrofit fire collars.
FSP 1902	AS 1530.4 - 2014	A fire resistance testing of nine (9) retrofit Fire Collars protecting a steel framed plasterboard wall system.
FSP 2049	AS 1530.4 - 2014	A fire resistance testing of an 1150-mm x 1150-mm x 120-mm thick concrete slab penetrated by three (3) floor wastes and two (2) stack pipes with multiple services protected by three (3) cast-in and two (2) retrofit fire collars.
FSP 2058	AS 1530.4 - 2014	A fire resistance testing of an 1150-mm x 1150-mm x 75-mm thick Hebel PowerPanel wall penetrated by five (5) services protected by retrofit fire collars
FSP 2118	AS 1530.4 - 2014	A fire resistance testing of an 1150-mm x 1150-mm x 75-mm thick Hebel PowerPanel wall penetrated by six (6) services protected by retrofit Snap Fire Systems fire collars.
FSP 2120	AS 1530.4 - 2014	A fire resistance testing of an 1150-mm x 1150-mm x 90-mm thick plasterboard wall system penetrated by six (6) services protected by retrofit fire collars.
FSP 2126	AS 1530.4 - 2014	A fire resistance testing of an 1150-mm x 1150-mm x 116-mm thick plasterboard wall system penetrated by six (6) services protected by retrofit fire collars.

The reports FSP 1990, FSP 1902, FSP 2049, FSP 2058, FSP 2118, FSP 2120, FSP 2126 were undertaken by CSIRO North Ryde and sponsored by IG6 Pty Ltd.

3 Proposed Variations

The proposed construction shall be Snap collars tested in Table 2, and subject to the following variations:

- The wall constructions tested shall vary from that tested to one of the following types as listed in Table 3.
- The service tested MSR 70 collars as shown in Table 2, may vary in any combination from the minimum to the maximum service sizes and collar fills as listed in Tables 4 and 5.
- Collars are fixed to substrates with the fixing shown in Table 6 below and as shown in the Figures 1-5.
- The aperture to aperture spacing in the substrate shall be at least 40mm as shown in Figures 6 and 7.
- Inclusion of Firesound sealant to fill gaps when cable and services are protected by MS70R collar without PVC conduits.
- The collar may include a mix services form Tables 4 and 5.
- The services are sealed at the wall with sealants as listed in Table 7

Table 1: Referenced test data for penetrations

Report	ID #	Collar Code	Element	Service	Details
FSP 1990	2	MS50R	2x13mm plasterboard sheets each side of a 64mm steel stud	3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging, 2.5mm² 4C+E round power cable and 20mm Pressure PVC	100% full
FSP 2049	4	MS70R	120mm concrete slab	3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging, 2.5mm² 3C+E round power cable and 20mm Pressure PVC	100% full Firesound to fill gaps
FSP 2058	3	MS70R	75mm Hebel PowerPanel	3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging, 2.5mm² 3C+E round power cable and 25mm Pressure PVC	100% full Firesound to fill gaps
FSP 2118	1	MS70R	75mm Hebel PowerPanel	50 PN6 PVC	
	2	MS70R		50mm Medium Duty Conduit filled with 2x6mm² 3C+E power cables 2x16mm² 3C+E power cables	Conduit 100% full
	3	MS70R		20xCat5e	20% full
	4	MS70R		100xCat5	100% full
	5	MS70R		1in copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	100% full
	6	MS70R		3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	100% full Firesound to fill gaps
FSP 2120	1	MS70R	1x13mm plasterboard sheets each side of a 64mm steel stud	1in copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	100% full
	2	MS70R		50mm Medium Duty Conduit filled with 2x16mm² 3C+E power cables 2x6mm² 3C+E power cables	Conduit 100% full

Report	ID #	Collar Code	Element	Service	Details
	3	MS70R		20xCat5	20% full
	4	MS70R		100xCat5	100% full
	5	MS70R		3/8in & 3/4in copper pair coil lagged in 9mm non-F/R lagging, 2.5mm² 3C+E round power cable and 25mm Pressure PVC	100% full Firesound to fill gaps
	6	MS70R		3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	100% full Firesound to fill gaps
FSP 2126	1	MS70R	2x13mm plasterboard sheets each side of a 64mm steel stud	1 inch copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	100% full
	2	MS70R		50mm Medium Duty Conduit filled with 2x16mm² 3C+E power cables 2x6mm² 3C+E power cables	Conduit 100% full
	3	MS70R		20xCat5	20% full
	4	MS70R		100xCat5	100% full
	5	MS70R		3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging, 2.5mm² 3C+E round power cable and 25mm Pressure PVC	100% full Firesound to fill gaps
	6	MS70R		3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	100% full Firesound to fill gaps

Table 3: Separating elements

Wall ID	Separating elements	Minimum wall thickness (mm)	Required separating element FRL
1	13mm fire rated plasterboard sheet each side of a 64mm steel stud	90	-/60/60
2	Minimum 90mm Concrete and Masonry Wall	90	-/60/60
3	16mm fire rated plasterboard sheet each side of a 64mm steel stud	96	-/90/90
4	10mm FireCrunch board each side of a 90mm steel stud + Rockwool insulation (as tested)	110	-/90/90
5	2 x 7.5mm Multiboard board each side of a 90mm steel stud	120	-/90/90
6	Minimum 75mm Hebel PowerPanel 90min wall	75	-/90/90
7	2x13mm fire rated plasterboard sheets each side of a 64mm steel stud	116	-/120/120
8	Minimum 75mm Hebel PowerPanel 120min wall	75	-/120/120
9	Minimum 78mm SpeedPanel Wall with 13mm plasterboard patch each side	78	-/120/120
10	Minimum 116mm Concrete and Masonry Wall	116	-/120/120
11	2x16mm fire rated plasterboard sheets each side of a 64mm steel stud	128	-/180/180

Table 4 – Services variations within the collar

Service	Detail		Sealant (Table 7)
Copper Pair Coil	**Pipe size**	**Lagging**	
	Min. ¼ inch & 3/8 inch	9mm PE foam lagging or 9mm F/R lagging	In the annular gap between wall aperture and services to a minimum depth of 10mm and finished off flush with the wall prior to the fitting of the collar.
	Max. 3/8 inch & ¾ inch	15mm PE foam lagging or 25mm F/R lagging	
Lagged Copper & Steel Pipes	**Pipe size**	**Lagging**	
	¼ inch	9mm PE foam lagging or 9mm F/R lagging	Optional
	¾ inch	15mm PE foam lagging or 25mm F/R lagging	
	1 inch	19 - 25mm F/R lagging	
Mix services	various	various	In the annular gap between wall aperture and services to a minimum depth of 10mm and finished off flush with the wall prior to the fitting of the collar.

Table 5: Conduit and Cable details

Service	Detail	Sealant (Table 7)
PVC Conduit (Light to Medium Duty) (Conduit Wall Thickness 1.6mm to 2.85mm)	20mm – 50mm PVC conduit (PVC conduit empty to full of data and communication cables as well as power cables as shown below)	Optional
Data and Comms Cables Cat5e, Cat6, Cat 7, Cat 8, RG6	Collar empty to collar 100% full	Optional
Fibre optic cables (12F NBN Optical Fibre Cables)	Collar empty to collar 100% full	Optional
Power Cables (Up to 16mm² 3C+E Cables)	Collar empty to collar 100% full	In the annular gap between wall aperture and services to a minimum depth of 10mm and finished off flush with the wall prior to the fitting of the collar.
Mix services	various	In the annular gap between wall aperture and services to a minimum depth of 10mm and finished off flush with the wall prior to the fitting of the collar.

Table 6: Collar to wall fixing fixings for each wall type

Element	Fixing (minimum size)
13mm and 16mm Plasterboard lined wall	M4 Expandable Steel Anchors
10mm and greater FIRECRUNCH and Multiboard Board lined Wall	M4 Expandable Steel Anchors
75mm Hebel PowerPanel Wall	14-10 65mm Hex Head Screws
78mm SpeedPanel Wall	14-10 65mm Hex Head Screws
Concrete or Masonry Wall	5mm x 30mm Concrete Screw Bolts

Table 7: Sealant at the wall

Product	Detail
HB Fullers FireSound "Fire Rated Acoustic Sealant"	Install around the perimeter of the service at the wall junctions where shown in figures 1.-4

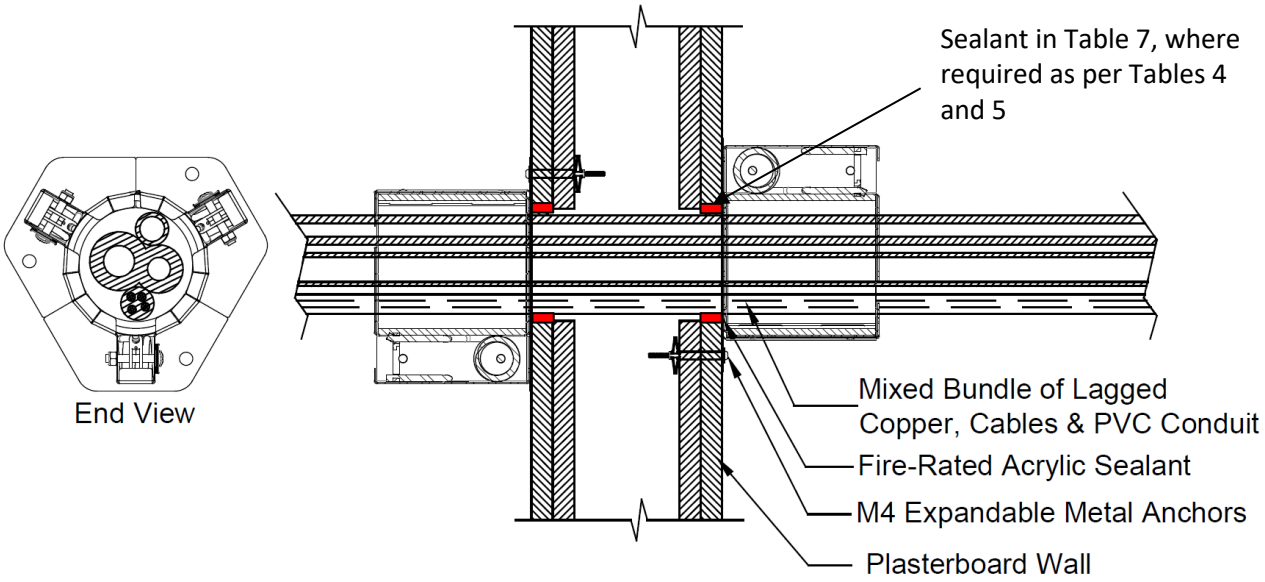

Figure 1: Plasterboard, FIRECRUNCH and Multiboard lined wall with collar

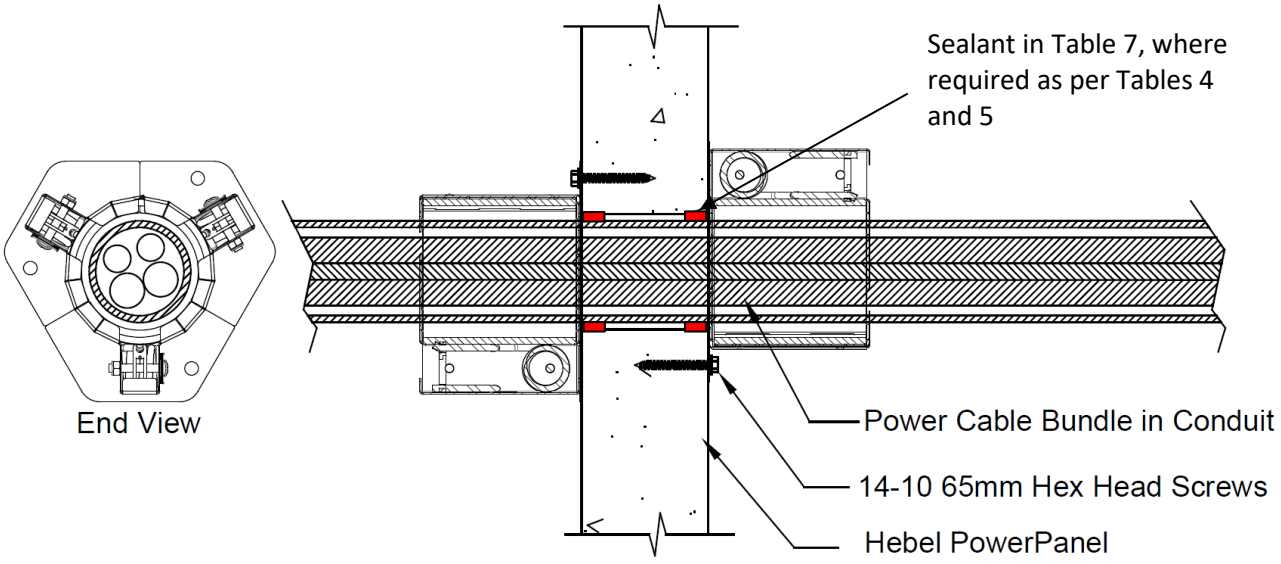

Figure 2: Hebel PowerPanel wall with collar

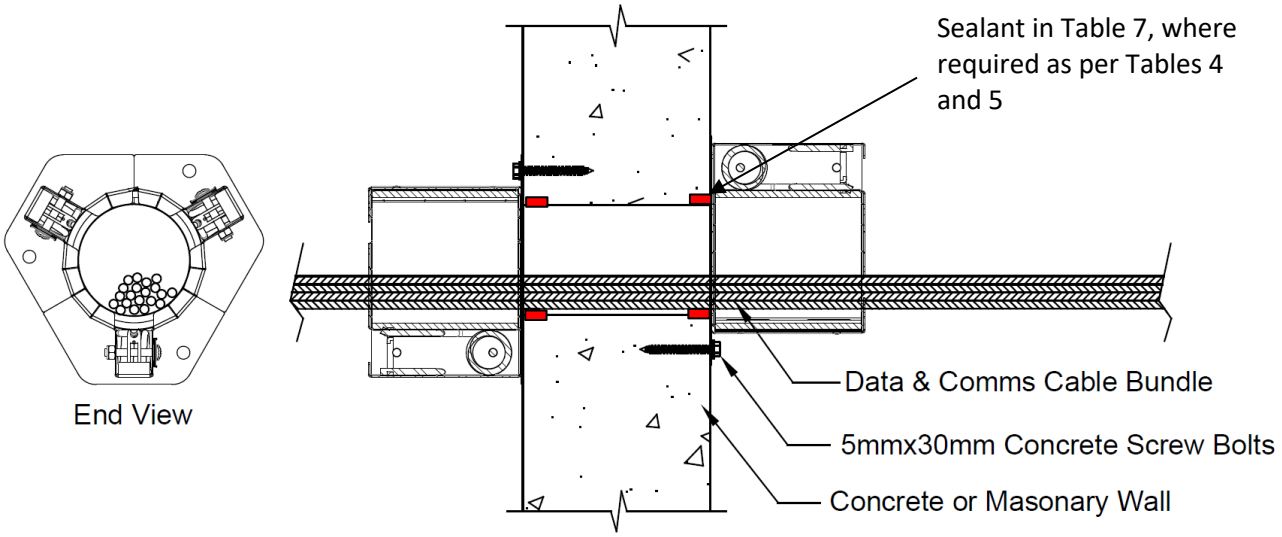

Figure 3: Concrete or Masonry wall with collar

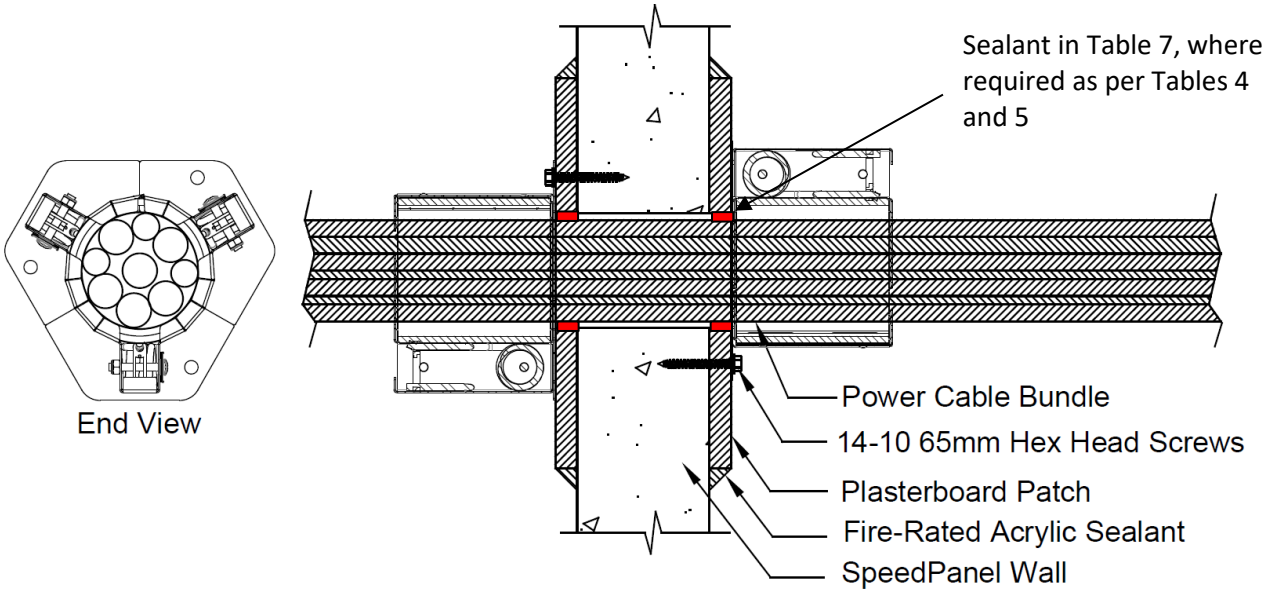

Figure 4: SpeedPanel Wall with collar

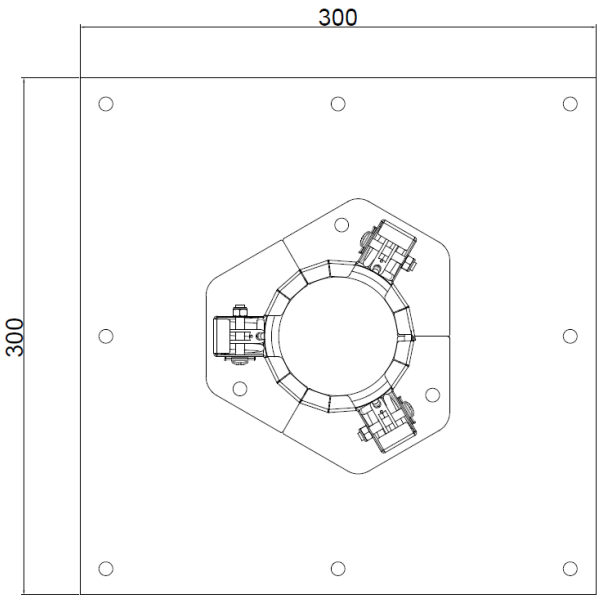

Figure 5: 13mm Fire grade plasterboard patch for SpeedPanel walls

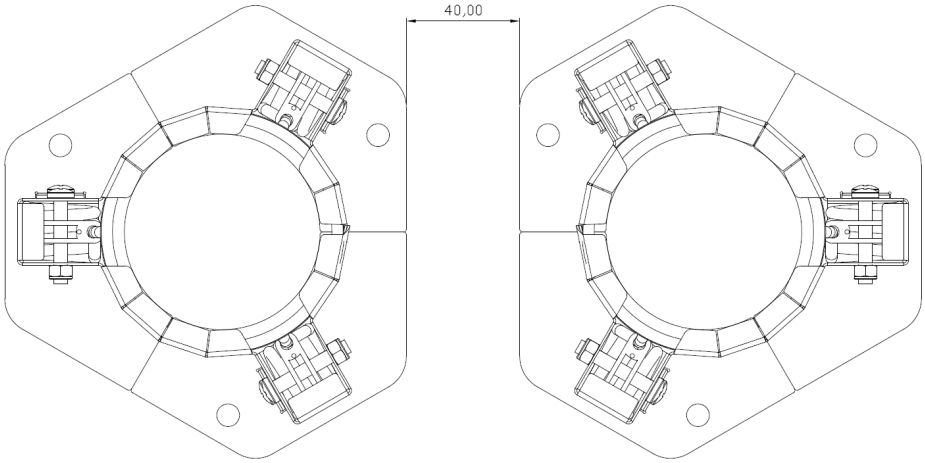

Figure 6: Collars when spaced 40mm apart

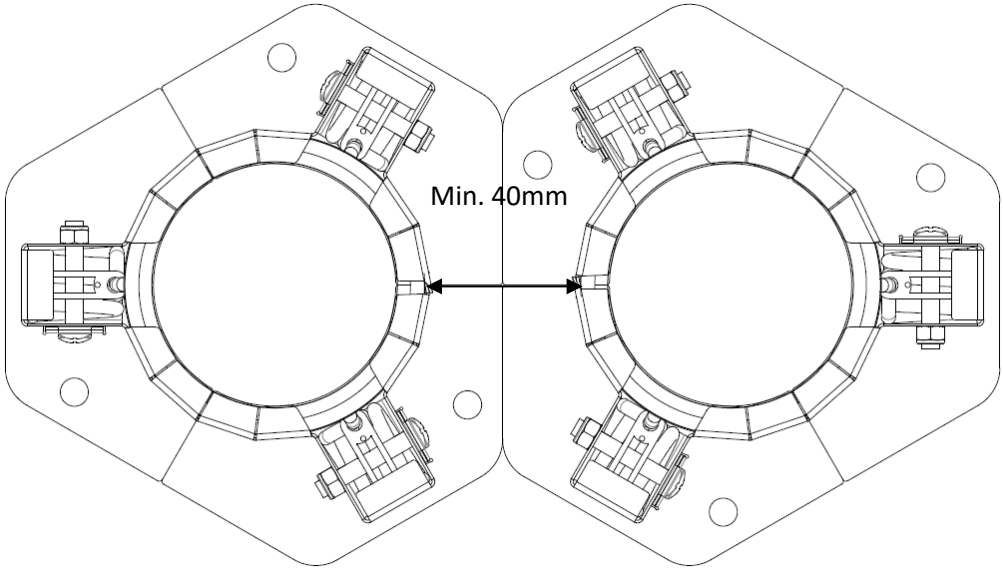

Figure 7: Collars when side by side

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, Section 10 as appropriate for service penetrations.
AS 4072.1-2005	Components for the protection of openings in fire-resistant separating elements Part 1: Service penetrations and control joints

5 Conclusion

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

Table 8 – Fire Resistance of SNAP MS70R collars 40mm apart (Figure 6)

Wall Types	Service in MS70R Collar						Mix services from Tables 4 and 5
	SEE TABLE 4		SEE TABLE 5				
	Pair Coil bundles	Lagged Copper and Steel Pipes	PVC Conduit with or without cables	Fibre Optic Cable bundle	Data and Comms Cable bundle	Power Cable bundle	
Plasterboard (Figure 1) and Masonry Walls (Figure 3)							
≥ 90mm Plasterboard wall (1 x 13mm + 64mm stud)	-/60/60						-/60/60
≥ 96mm Plasterboard wall (1 x 16mm + 64mm stud)	-/90/60					-/90/90	-/90/60
≥ 116mm Plasterboard wall (2 x 13mm + 64mm stud) **And** ≥ 120mm Concrete or Masonry Wall	-/120/120						-/120/120
≥ 128mm Plasterboard wall (2 x 16mm + 64mm stud)	-/120/120	-/180/120			-/180/180		-/120/120
AAC Concrete Wall Systems (Figures 2 and 4)							
75mm Hebel PowerPanel (90 minute system)	-/90/90						-/90/90
75mm Hebel Power Panel (120 minute system)	-/120/90		-/120/120			-/120/90	-/120/90
78mm SpeedPanel with PB patch (Figure 5)	-/120/90		-/120/120			-/120/90	-/120/90
Framed MgO Wall Systems (Figure 1)							
FireCrunch MgO Board Wall (10mm)	-/90/60					-/90/90	-/90/60
Multiboard MgO Wall (2 x 7.5mm)	-/90/60					-/90/90	-/90/60

Table 10 – Fire Resistance of SNAP MS70R collars flange to flange (Figure 7)

Wall Types	Service in MS70R Collar					
	SEE TABLE 4		SEE TABLE 5			
	Pair Coil bundles	Lagged Copper and Steel Pipes	PVC Conduit with or without cables	Fibre Optic Cable bundle	Data and Comms Cable bundle	Power Cable bundle
Plasterboard (Figure 1) and Masonry Walls (Figure 3)						
≥ 90mm Plasterboard wall (1 x 13mm + 64mm stud)	-/60/60					
≥ 96mm Plasterboard wall (1 x 16mm + 64mm stud)	-/90/60					
≥ 116mm Plasterboard wall (2 x 13mm + 64mm stud) **And** ≥ 120mm Concrete or Masonry Wall	-/120/120					
≥ 128mm Plasterboard wall (2 x 16mm + 64mm stud)	-/180/120					
AAC Concrete Wall Systems (Figures 2 and 4)						
75mm Hebel PowerPanel (90 minute system)	-/90/90					
75mm Hebel Power Panel (120 minute system)	-/120/90					
78mm SpeedPanel with 13mm PB patch (Figure 5)	-/120/90					
Framed MgO Wall Systems (Figure 1)						
FireCrunch MgO Board Wall (10mm)	-/90/60					
Multiboard MgO Wall (2 x 7.5mm)	-/90/60					

6 Direct Field of Application of Results

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

7 Requirements

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

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

9 Limitations

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

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

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

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

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

Appendix A Supporting Test Data

A.1. Test report FSP 1990

On 21 March 2019, CSIRO North Ryde conducted a fire resistance test on an 1160-mm x 1160-mm x 116-mm thick wall penetrated by two (2) pipes protected by retrofitted Snap Fire Systems fire collars. Only specimen 2 is referenced in this report.

The wall system was described as a 116-mm thick plasterboard lined steel framed wall comprising two layers of 13-mm thick Firestop plasterboard on each side of 64-mm deep metal studs, Boral reference SB120.1 with an established FRL of -/120/120.

Specimen 2 - SNAP MS50R Multi Services Retrofit fire collar protecting a ¾-in & ⅜ in Pair Coils, 12-mm Electrical cable and a nominal 20-mm PVC conduit.

The SNAP Multi Service Retrofit MS50R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm steel base flange with a 160-mm diameter. The 65-mm high collar casing incorporated a closing mechanism which comprised a soft Intumesh intumescent wraps 4-mm thick x 60-mm wide x 252-mm long lined within the internal circumference of the collar. The closing mechanism comprised three stainless steel springs, with a nylon fuse link, and a 260-mm long x 58-mm wide 316 stainless steel mesh located around the intumescent strip as shown in drawing numbered MS50R dated 12 March 2019, by Snap Fire Systems Pty Ltd. The Snap collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through 3 mounting brackets using M4 expandable steel anchors. The annular gap around the pipe and plasterboard on both sides of the wall was filled with H.B Fullers Firesound sealant to a depth of 10-mm and finished flush with the wall.

The penetrating service comprised a cluster of pipes and cables; a ¾-in and a ⅜-in copper pipe both having a wall thickness of 1-mm and both covered with a 10-mm thick crosslinked PE foam lagging, a 12-mm grey electrical cable (4 core plus Earth) and a 20-mm PVC conduit with a wall thickness of 2.2-mm which all penetrated the wall through a 64-mm diameter cut-out hole as shown in drawing titled “Specimen # 2, 3/4 & 3/8 Insulated Copper Pair Coil, 20 PVC Conduit, 4 Core Cable + E & MS50R, dated 20 February 2019”, provided by Snap Fire Systems Pty Ltd. The 20-mm PVC conduct projected horizontally 2000-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber and was supported at nominally 500-mm, and 1500-mm from the unexposed face of the plasterboard wall. The ¾-in and ⅜-in copper lagged pipes, and the electrical cable projected horizontally 500-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber and was supported at nominally 500-mm from the unexposed face of the plasterboard wall. The 20-mm PVC conduit was open at the unexposed end and capped with a Superwool plug on the exposed end. The copper pipes in the 3/4 & 3/8 Pair Coil were crimped on the exposed end.

The specimen failed insulation at 59 minutes on the large lagged copper on the unexposed face. It maintained integrity for the 122 minutes duration of the test.

A.2. Test report FSP 1902

On 5 April 2018, CSIRO North Ryde conducted a fire resistance test on nine (9) retrofit Fire Collars protecting a steel framed plasterboard wall system. Only specimen 5 is referenced in this report.

The wall system is described as a 116 mm thick plasterboard lined steel framed wall comprising two layers of 13 mm thick Fyrchek plasterboard on each side of 64 mm deep metal studs.

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

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 316 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 5 October 2017, by Snap Fire Systems Pty Ltd. The Snap collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through 3 mounting brackets using 38-mm (10g) coarse thread laminating screws.

The penetrating service comprised a 20-mm Telstra PVC conduit, with a wall thickness of 1.8 mm penetrating the wall through a 32-mm diameter cut-out hole as shown in drawing titled “Specimen # 5, Telstra 20 PVC Conduit + 5 x optical fibres stated by the manufacturer to be “12F NBN Optical Fibre Cables” & 32R, dated 21 March 2018”, provided by Snap Fire Systems Pty Ltd. The conduit projected horizontally, 2000-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber. The conduit was supported at nominally 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The conduit was open at the unexposed and capped with a Superwool plug on the exposed end. The conduit contained five optical fibre cables.

The specimen was able to maintain integrity for the 181 minutes duration of the test and failed insulation on the wall at 170 minutes.

A.3. Test report FSP 2049

On 24 September 2019, CSIRO North Ryde conducted a fire resistance test on an 1150-mm x 1150-mm x 120-mm thick concrete slab penetrated by three (3) floor wastes and two (2) stack pipes with multiple services protected by three (3) cast-in and two (2) retrofit fire collars. Only specimen 4 is referenced in this report.

The penetrated slab comprised a 120-mm thick concrete slab reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 120 minutes in accordance with table 5.5.1 of AS 3600:2018 - Concrete structures.

Specimen 4 - SNAP MS70R Multi Services Retrofit fire collar protecting a ¾-in and a ⅜-in Pair Coil, 12 mm electrical cable and a nominal 20-mm PVC conduit.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75 mm thick steel casing with a 69-mm inner diameter and a 0.95-mm steel base flange with a 162-mm diameter. The 95-mm high collar casing incorporated a closing mechanism which comprised a soft Intumesh intumescent wrap, 4-mm thick x 90-mm wide x 250-mm long lined within the internal circumference of the collar. The closing mechanism comprised three stainless steel springs, with a nylon fuse link, and a 258 mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip. The Snap collar was surface mounted around the pipe on the exposed face of the slab and fixed using three 5-mm x 35-mm concrete screws.

The annular gap around the pipe and slab on the exposed face was filled with H.B Fullers Firesound sealant to a depth of 10-mm.

The penetrating service comprised a cluster of two lagged copper pipes, a PVC conduit and an electrical cable. The ¾-in and ⅜-in copper pipes, having a wall thickness of 1.5-mm and 1.0mm respectively and both covered with a 10-mm thick crosslinked non-fire-rated PE foam lagging, a 12-mm grey electrical cable (3 core plus Earth) and a 20-mm PVC conduit with a wall thickness of 2.2 mm, all of which penetrated the slab through a 64-mm diameter cut-out hole.

The 20-mm PVC conduct projected horizontally 2000-mm away from the unexposed face of the slab and approximately 500 mm into the furnace chamber and was supported at nominally 500-mm, and 1500-mm from the unexposed face of the slab. The ¾-in and ⅜-in copper lagged pipes and the electrical cable projected vertically 500-mm from the unexposed face of the slab and approximately 500 mm into the furnace chamber and were supported at nominally 500-mm from the unexposed face of the slab. The 20-mm PVC conduit was open at the unexposed end and capped with a Superwool plug on the exposed end. The ¾-in and ⅜-in copper pipes were left open on the unexposed face and crimped on the exposed end.

The specimen failed insulation at 162 minutes on the electric cable 25-mm above the mastic on the unexposed face. It maintained integrity for the 241 minutes duration of the test.

A.4. Test report FSP 2058

On 7 November 2019, CSIRO North Ryde conducted a fire resistance test on an 1150-mm x 1150-mm x 75-mm thick Hebel PowerPanel wall penetrated by five (5) services protected by retro-fitted Snap Fire Systems fire collars. Only specimen 3 is referenced in this report.

The wall comprised a 75-mm thick Hebel PowerPanel autoclaved aerated concrete (AAC) wall system with an established fire resistance level (FRL) of -/90/90 as detailed in CSIRO test report FSV 0979.

Specimen 3 - SNAP MS70R Multi Services Retrofit fire collar protecting a ¾-in and a ⅜-in Pair Coil pipes, a nominal 25-mm pressure PVC pipe and a 10-mm Electrical cable.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75 mm thick steel casing with a 69 mm inner diameter and a 0.95-mm steel base flange with a 162-mm diameter. The 95-mm high collar casing incorporated a closing mechanism which comprised soft Intumesh intumescent wraps, 4-mm thick x 90-mm wide x 250-mm long lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, with a nylon fuse link, and a 258 mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip. The Snap collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through 3 mounting brackets using 14-10 65-mm hex head screws.

The penetrating service comprised a cluster of pair coil pipes ¾-in and a ⅜-in copper having a wall thickness of 1-mm and 1.5-mm respectively and both covered with a 10-mm thick crosslinked non-fire-rated PE foam lagging. Additional services included a 10-mm grey electrical cable (3 core plus Earth) and a 25-mm PVC pressure pipe with a wall thickness of 2.2 mm; which all penetrated the wall through a 64-mm diameter cut-out hole.

The 25-mm pressure PVC conduct projected horizontally 2000-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber, and was supported at nominally 500-mm, and 1500-mm from the unexposed face of the wall. The ¾-in and ⅜-in copper lagged pair coil pipes and the electrical cable projected horizontally 500-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber and were supported at nominally 500-mm from the wall. The 25-mm pressure PVC pipe was open on the unexposed end and capped with a Superwool plug on the exposed end. The ¾-in and ⅜-in copper pipes were left open on the unexposed face and crimped closed on the exposed end.

The specimen failed insulation at 98 minutes on the ¾-inch insulated copper pair coil pipes, 25-mm from the collar. It maintained integrity for the 121 minutes duration of the test.

A.5. Test report FSP 2118

On 23 June 2020, CSIRO North Ryde conducted a fire resistance test on an 1150-mm x 1150-mm x 75-mm thick Hebel PowerPanel wall penetrated by six (6) services protected by retro-fitted Snap Fire Systems fire collars.

The wall comprised a 75-mm thick Hebel PowerPanel autoclaved aerated concrete (AAC) wall system with an established fire resistance level (FRL) of -/90/90, as detailed in CSIRO test report FSV 0979.

Specimen 1 - SNAP MS70R Multi Services Retrofit fire collars protecting a nominal 50-mm polyvinyl chloride (PVC-U) pipe.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled “SNAP 70 Multi Service Retro”, dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration using three 14-10 65-mm Hex Head Screws.

The penetrating service comprised a 60.32-mm outside diameter Vinidex PN6 (PVC-U) pipe, with a wall thickness of 1.84 mm, fitted through the collar’s sleeve and penetrated the wall through a 64 mm diameter cut-out hole, as shown in drawing titled “Specimen #1 50 PN6 PVC Pipe & MS70R Collar”, dated 9 June 2020, by Snap Fire Systems Pty Ltd.

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

The pipe was open at the unexposed end and plugged with ceramic fibre (Superwool) on the exposed end.

Specimen 2 - SNAP MS70R Multi Services Retrofit fire collar protecting a nominal 50-mm PVC conduit incorporating two 6-mm2 3C+E and two 16-mm2 3C+E power cables

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled “SNAP 70 Multi Service Retro”, dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration using three 14-10 65-mm Hex Head Screws.

The penetrating service comprised a 60-mm outside diameter Telstra PVC conduit with a wall thickness of 2.71 incorporating two 6-mm2 3-core+E power cables and two 16-mm^2 3 core+E power cables running through the conduit. All the cables were manufactured by General Cables.

The PVC conduit containing the four power cables was fitted through the collar’s sleeve and penetrated the wall through a 64-mm diameter cut-out hole as shown in drawing titled “Specimen #2 50 PVC Conduit with 16mm^2 3C+E & 6mm^2 3C+E Power Cables & MS70R Collar”, dated 9 June 2020, by Snap Fire Systems Pty Ltd”, dated 9 June 2020, by Snap Fire Systems Pty Ltd.

The conduit and cables projected horizontally, 2000-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber and was supported at nominally 500-mm and 1500-mm from the unexposed face of the Hebel wall.

The conduit was open at the unexposed end and plugged with ceramic fibre (Superwool) on the exposed end.

Specimen 3 - SNAP MS70R Multi Services Retrofit fire collars protecting a bundle of 20 Category 5e network cables.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip as shown in drawing titled "SNAP 70 Multi Service Retro", dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration using three 14-10 65-mm Hex Head Screws.

The penetrating service comprised a bundle of 20 x 5-mm diameter ADC Krone Category 5e network cables. The cables were fitted through the collar's sleeve and penetrated the wall through a 70-mm diameter cut-out hole, as shown in drawing titled "Specimen #3 20% Full of Cat5e Cables & MS70R Collar", dated 9 June 2020, by Snap Fire Systems Pty Ltd.

The cables projected horizontally 550-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber and were supported at nominally 500-mm from the unexposed face of the Hebel wall.

Specimen 4 - SNAP MS70R Multi Services Retrofit fire collars protecting a bundle of 100 Category 5e network cables.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip as shown in drawing titled "SNAP 70 Multi Service Retro", dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration using three14-10 65-mm Hex Head Screws.

The penetrating service comprised a bundle of 100 x 5-mm diameter ADC Krone Category 5e network cables. The cables were fitted through the collar's sleeve and penetrated the wall through a 70-mm diameter cut-out hole as shown in drawing titled "Specimen #4 100% Full of Cat5e Cables & MS70R Collar", dated 9 June 2020, by Snap Fire Systems Pty Ltd.

The cables projected horizontally 550-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber and were supported at nominally 500-mm from the unexposed face of the Hebel wall.

Specimen 5 - SNAP MS70R Multi Services Retrofit fire collars protecting a DN25B copper pipe with 19-mm F/R lagging and a thermoplastic-sheathed cable (TPS).

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm steel thick base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip as shown in drawing titled "SNAP 70 Multi Service Retro", dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration using three 14-10 65-mm Hex Head Screws.

The penetrating service comprised a 1-inch outside diameter copper pipe with a wall thickness of 1.1 mm, lagged with 19-mm thick E-flex insulation as well as a 3-core 2.5 mm2 TPS cable. The lagged pipe and cable were fitted through the collar's sleeve and penetrated the wall through a 64-mm diameter cut-out hole as shown in drawing titled "Specimen #5 1inch Copper Tube with 19mm F/R Lagging, 2.5mm² 3C TPS Cable & MS70R Collar", dated 9 June 2020, by Snap Fire Systems Pty Ltd.

The lagged pipe and cable projected horizontally 550-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber. The lagged pipe and cable were supported at nominally 500 mm from the unexposed face of the Hebel wall.

Specimen 6 - SNAP MS70R Multi Services Retrofit fire collars protecting a bundle of six 16-mm2 3C+E and three 6-mm2 3C+E power cables.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled “SNAP 70 Multi Service Retro”, dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration using three 14-10 65-mm Hex Head Screws.

The penetrating service comprised a bundle of six 16-mm2 3-core+E power cables and three 6-mm2 3-core+E power cables. All power cables were manufactured by General Cables. The cables were fitted through the collar’s sleeve and penetrated the wall through a 70-mm diameter cut-out hole, as shown in drawing titled “Specimen #6 16mm² 3C+E & 6mm² 3C+E Power Cables & MS70R Collar”, dated 9 June 2020, provided by Snap Fire Systems Pty Ltd.

The annular gap around the pipe and Hebel PowerPanel on both sides of the wall was filled with a 10-mm deep bead H.B Fullers Firesound sealant. The cables projected horizontally 550-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber. The cables were supported at nominally 500-mm from the unexposed face of the Hebel wall.

Specimen 4 failed insulation at 117 minutes on the Hebel wall 25-mm from the right hand side of the collar. Specimen 5 failed insulation at 118 minutes on the right hand side of the collar. Specimen 6 failed insulation at 119 minutes on the 16-mm^2 power cables 25-mm from the collar. Specimen 3 failed insulation at 120 minutes on the Hebel wall 25-mm from the right hand side of the collar. All 6 specimens were able to maintain integrity for the 121 minutes duration of the test.

A.6. Test report FSP 2120

On 29 June 2020, CSIRO North Ryde conducted a fire resistance test on an 1150-mm x 1150-mm x 90-mm thick plasterboard wall system penetrated by six (6) services protected by retro-fitted Snap Fire Systems fire collars.

The plasterboard wall was constructed in accordance with Boral Firestop system SB60.1 with an established fire resistance level (FRL) of -/60/60 as detailed in the document titled “Plasterboard Fire and Acoustic Systems Australia”, revision UB1231-SYS 12/18, by USG Boral Building Products Pty Ltd. Construction comprised a 64-mm x 0.55-mm steel studs installed at nominally 600-mm centres, lined on each side with a single layer of 13-mm thick Boral Firestop plasterboard sheets. The plasterboard sheeting was screw fixed to the steel studs using 6g x 32-mm plasterboard screws at nominally 200-mm centres. The wall cavity was filled with a single layer of 50 mm thick Acoustigard 11 insulation.

Specimen 1 - SNAP MS70R Multi Services Retrofit fire collars protecting a DN25B copper tube with 19-mm F/R lagging and a thermoplastic-sheathed cable (TPS).

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled “SNAP 70 Multi Service Retro”, dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a

back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a 25-mm diameter copper pipe with a wall thickness of 1.1-mm, lagged with 19-mm thick E-flex insulation and a 3-core 2.5-mm^2 TPS cable. The lagged pipe and cable were fitted through the collar's sleeve and penetrated the wall through a 64-mm diameter cut-out hole as shown in drawing titled "Specimen #1 1 inch Copper Tube with 19mm F/R Lagging, 2.5mm² 3C TPS Cable & MS70R Collar", dated 10 June 2020, by Snap Fire Systems Pty Ltd.

The lagged pipe and cable projected horizontally 550-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber. The lagged pipe and cable were supported at nominally 500-mm from the unexposed face of the plasterboard wall. The copper pipe was left open on the unexposed face and crimped closed on the exposed end.

Specimen 2 - SNAP MS70R Multi Services Retrofit fire collar protecting a nominal 50-mm PVC conduit incorporating two 6-mm^2 3C+E and two 16-mm^2 3C+E power cables.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled "SNAP 70 Multi Service Retro", dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a 60-mm outside diameter Telstra PVC conduit with a wall thickness of 2.71-mm containing two 6-mm^2 3-core+E power cables and two 16-mm^2 3-core+E power cables running through the conduit. All the power cables were manufactured by General Cables.

The PVC conduit and four power cables were fitted through the collar's sleeve and penetrated the wall through a 64-mm diameter cut-out hole as shown in drawing titled "Specimen #2 50 PVC Conduit with 16mm² 3C+E & 6mm² 3C+E Power Cables & MS70R Collar", dated 10 June 2020, by Snap Fire Systems Pty Ltd. The conduit and cables projected horizontally 2000-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber. The conduit was supported at nominally 500-mm and 1500-mm from the unexposed face of the plasterboard wall. The conduit was open at the unexposed end and plugged with ceramic fibre (Superwool) on the exposed end.

Specimen 3 - SNAP MS70R Multi Services Retrofit fire collars protecting a bundle of 20 Category 5e network cables.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled "SNAP 70 Multi Service Retro", dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a bundle of 20 x 5-mm diameter ADC Krone Category 5e network cables. The cables were fitted through the collar's sleeve and penetrated the wall through a 70-mm diameter cut-out hole as shown in drawing titled "Specimen #3 20% Full of Cat5e Cables & MS70R Collar", dated 10 June 2020, by Snap Fire Systems Pty Ltd.

The cables projected horizontally 550-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber. The cables were supported at nominally 500-mm from the unexposed face of the plasterboard wall.

Specimen 4 - SNAP MS70R Multi Services Retrofit fire collars protecting a bundle of 100 Category 5e network cables.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled "SNAP 70 Multi Service Retro", dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a bundle of 100 x 5-mm diameter ADC Krone Category 5e network cables. The cables were fitted through the collar's sleeve and penetrated the wall through a 70-mm diameter cut-out hole as shown in drawing titled "Specimen #4 100% Full of Cat5e Cables & MS70R Collar", dated 10 June 2020, by Snap Fire Systems Pty Ltd.

The cables projected horizontally 550-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber. The cables were supported at nominally 500-mm from the unexposed face of the plasterboard wall.

Specimen 5 - SNAP MS70R Multi Services Retrofit fire collar protecting a ¾-inch and a ⅜-inch Pair Coil, a nominal 25-mm PN12 PVC-U pipe and a 2.5-mm^2 3C+E power cable.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled "SNAP 70 Multi Service Retro", dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a ¾-inch and a ⅜-inch pair coil, a PN12 PVC-U pipe and a 2.5-mm^2 3C+E power cable. The Ardent pair coil comprised two copper pipes having outside diameters of 9.82-mm, 19.05-mm and wall thicknesses of 0.81-mm and 1.14-mm respectively with both pipes covered with a 10-mm thick crosslinked non-fire-rated PE foam lagging. The Pipemaster PN12 PVC-U pipe had an outside diameter of 26.82-mm and wall thickness of 1.6-mm. The Electra Cables comprised a 2.5-mm^2 3C+E power cable with an outside diameter of 11.1-mm.

The pair coil, PVC pipe and power cable were fitted through the collar's sleeve and penetrated the wall through a 64-mm diameter cut-out hole as shown in drawing titled "Specimen #5 ¾-in & ⅜-in Insulated Copper Pair Coil, 25-mm Pressure PVC, 2.5mm^2 3C+E Cable & MS70R", dated 10 June 2020", by Snap Fire Systems Pty Ltd. The annular gap around pair coils, PVC pipe, cable and plasterboard on both sides of the wall was filled with a 10-mm deep bead H.B Fullers Firesound sealant.

The 25-mm PVC conduit projected horizontally 2000-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber and was supported at nominally 500-mm, and 1500-mm from the unexposed face of the wall. The ¾-inch and ⅜-inch copper lagged pair coil pipes and the power cable projected horizontally 550-mm away from the unexposed face of the wall and approximately 500 mm into the furnace chamber and were supported at nominally 500-mm from the wall. The 25-mm pressure PVC pipe was open on the unexposed end and plugged with a ceramic fibre

(Superwool) plug on the exposed end. The ¾-inch and ⅜-inch copper pipes were left open on the unexposed face and crimped closed on the exposed end.

Specimen 6 - SNAP MS70R Multi Services Retrofit fire collars protecting a bundle of six 16-mm^2 3C+E and three 6-mm^2 3C+E power cables.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled "SNAP 70 Multi Service Retro", dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a bundle of six 16-mm^2 3-core+E power cables and three 6-mm^2 3-core+E power cables. All the cables were manufactured by General Cables. The cables were fitted through the collar's sleeve and penetrated the wall through a 70-mm diameter cut-out hole as shown in drawing titled "Specimen #6 16mm^2 3C+E & 6mm^2 3C+E Power Cables & MS70R Collar", dated 10 June 2020, by Snap Fire Systems Pty Ltd.

The annular gap around the cables and plasterboard on both sides of the wall was filled with a 10-mm deep bead H.B Fullers Firesound sealant. The cables projected horizontally 550-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber. The cables were supported at nominally 500-mm from the unexposed face of the plasterboard wall.

Specimen 2 failed insulation at 77 minutes on the right side of the collar. Specimen 1 failed insulation at 78 minutes on the plasterboard wall 25-mm above the collar. Specimen 3 failed insulation at 79 minutes on the plasterboard wall 25-mm above the collar. Specimen 4 failed insulation at 80 minutes on the plasterboard wall 25-mm above the collar. Specimen 5 failed insulation at 83 minutes on the plasterboard wall 25-mm above the collar. All 6 specimens were able to maintain integrity for the 91 minutes duration of the test.

A.7. Test report FSP 2126

On 6 July 2020, CSIRO North Ryde conducted a fire resistance test on an 1150-mm x 1150-mm x 116-mm thick plasterboard wall system penetrated by six (6) services protected by retro-fitted Snap Fire Systems fire collars.

The plasterboard wall was constructed in accordance with Boral Firestop system SB120.1 with an established fire resistance level (FRL) of -/120/120 as detailed in the document titled "Plasterboard Fire and Acoustic Systems Australia", revision UB1231-SYS 12/18, by USG Boral Building Products Pty Ltd. Construction comprised a 64-mm x 0.55-mm steel studs installed at nominally 600-mm centres, lined on each side with two layers of 13-mm thick Boral Firestop plasterboard sheets. The plasterboard sheeting was screw fixed to the steel studs using 6g 32-mm and 45-mm plasterboard screws at nominally 200-mm centres. The wall cavity was filled with a single layer 50 mm thick Acoustigard 11.

Specimen 1 - SNAP MS70R Multi Services Retrofit fire collars protecting a DN25B copper tube with 19-mm F/R lagging and a thermoplastic-sheathed cable (TPS).

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95 mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh

located around the intumescent strip, as shown in drawing titled “SNAP 70 Multi Service Retro”, dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a 1-inch outside diameter copper pipe with a wall thickness of 1.1-mm, lagged with 19-mm thick E-flex insulation and a 3-core 2.5-mm^2 TPS cable. The lagged pipe and cable were fitted through the collar’s sleeve and penetrated the wall through a 64-mm diameter cut-out hole as shown in drawing titled “Specimen #1 1inch Copper Tube with 19mm F/R Lagging, 3C TPS Cable & MS70R Collar”, dated 11 June 2020, by Snap Fire Systems Pty Ltd.

The lagged pipe and cable projected horizontally, 550-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber and were supported at nominally 500-mm from the unexposed face of the plasterboard wall. The 1-inch copper pipe was left open on the unexposed end and crimped closed on the exposed end.

Specimen 2 - SNAP MS70R Multi Services Retrofit fire collar protecting a nominal 50-mm PVC conduit incorporating two 6-mm^2 3C+E and two 16-mm^2 3C+E power cables.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95-mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled “SNAP 70 Multi Service Retro”, dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a 60-mm outside diameter Telstra PVC conduit with a wall thickness of 2.71-mm containing two 6-mm^2 3-core+E power cables and two 16-mm^2 3-core+E power cables running through the conduit. All the power cables were manufactured by General Cables. The PVC conduit and four power cables were fitted through the collar’s sleeve and penetrated the wall through a 64-mm diameter cut-out hole as shown in drawing titled “Specimen #2 50 PVC Conduit with 16mm² 3C+E & 6mm² 3C+E Power Cables & MS70R Collar”, dated 11 June 2020, by Snap Fire Systems Pty Ltd. The conduit and cables projected horizontally, 2000-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber. The conduit was supported at nominally 500-mm and 1500-mm from the unexposed face of the plasterboard wall. The conduit was open at the unexposed end and plugged with ceramic fibre (Superwool) on the exposed end.

Specimen 3 - SNAP MS70R Multi Services Retrofit fire collars protecting a bundle of 20 Category 5e network cables.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95--mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled “SNAP 70 Multi Service Retro”, dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a bundle of 20 ADC Krone Category 5e network cables. The cables were fitted through the collar’s sleeve and penetrated the wall through a 70-mm diameter cut-out hole as shown in drawing titled “Specimen #3 20% Full of Cat5e Cables & MS70R Collar”, dated 11 June 2020, by Snap Fire Systems Pty Ltd.

The cables projected horizontally 550-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber. The cables were supported at nominally 500-mm from the unexposed face of the plasterboard wall.

Specimen 4 - SNAP MS70R Multi Services Retrofit fire collars protecting a bundle of 100 Category 5e network cables.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95- mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled "SNAP 70 Multi Service Retro", dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a bundle of 100 ADC Krone Category 5e network cables. The cables were fitted through the collar's sleeve and penetrated the wall through a 70-mm diameter cut-out hole as shown in drawing titled "Specimen #4 100% Full of Cat5e Cables & MS70R Collar", dated 11 June 2020, by Snap Fire Systems Pty Ltd.

The cables projected horizontally, 550-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber. The cables were supported at nominally 500-mm from the unexposed face of the plasterboard wall.

Specimen 5 - SNAP MS70R Multi Services Retrofit fire collar protecting a ¾-in and a ⅜-in Pair Coil, a nominal 25-mm PN12 PVC-U pipe and a 2.5-mm^2 3C+E power cable.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95--mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled "SNAP 70 Multi Service Retro", dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a ¾-in and a ⅜-in pair coil, a PN12 PVC-U pipe and a 2.5-mm^2 3C+E power cable. The Ardent pair coil comprised two copper pipes having outside diameters of 9.82-mm, 19.05-mm and wall thicknesses of 0.81-mm and 1.14-mm respectively with both pipes covered with a 10-mm thick crosslinked non-fire-rated PE foam lagging. The Pipemaster PN12 PVC-U pipe had an outside diameter of 26.82-mm and wall thickness of 1.6-mm. The Electra Cables comprised a 2.5-mm^2 3C+E power cable with an outside diameter of 11.1-mm. The pair coil, PVC pipe and power cable were fitted through the collar's sleeve and penetrated the wall through a 64-mm diameter cut-out hole as shown in drawing titled "Specimen #5 ¾-in & ⅜-in Insulated Copper Pair Coil, 25-mm Pressure PVC, 2.5mm² 3C+E Cable & MS70R", dated 11 June 2020", provided by Snap Fire Systems Pty Ltd. The annular gap around the pair coil, PVC pipe, cable and plasterboard on both sides of the wall was filled with a 10-mm deep bead of H.B Fullers Firesound sealant.

The 25-mm pressure PVC conduit projected horizontally 2000-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber and was supported at nominally 500-mm and 1500-mm from the unexposed face of the wall. The ¾-in and ⅜-in copper lagged pair coil pipes and the power cable projected horizontally 550-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber and were supported at nominally 500-mm from the unexposed face of the wall. The 25-mm pressure PVC pipe was open on the unexposed end and capped

with a ceramic fibre (Superwool) plug on the exposed end. The ¾-in and ⅜-in copper pipes were left open on the unexposed face and crimped closed on the exposed end.

Specimen 6 - SNAP MS70R Multi Services Retrofit fire collars protecting a bundle of six 16-mm^2 3C+E and three 6-mm^2 3C+E power cables.

The SNAP Multi Service Retrofit MS70R fire collar comprised a 0.75-mm thick steel casing with a 69-mm inner diameter and a 0.95-mm thick steel base flange with a 162-mm diameter. The 95-mm high collar casing incorporated a 4-mm thick x 90-mm wide x 250-mm long soft Intumesh intumescent wrap lined within the internal circumference of the collar casing. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 258-mm long x 88-mm wide 316 stainless steel mesh located around the intumescent strip, as shown in drawing titled “SNAP 70 Multi Service Retro”, dated 23 September 2019, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the wall in a back-to-back configuration through the collar mounting brackets using three M4 expandable steel anchors.

The penetrating service comprised a bundle of six 16-mm^2 3-core+E power cables and three 6-mm^2 3-core+E power cables. All the cables were manufactured by General Cables. The cables were fitted through the collar’s sleeve and penetrated the wall through a 70-mm diameter cut-out hole as shown in drawing titled “Specimen #6 16mm² 3C+E & 6mm² 3C+E Power Cables & MS70R Collar”, dated 11 June 2020, by Snap Fire Systems Pty Ltd.

The annular gap around the cables and plasterboard on both sides of the wall was filled with a 10-mm deep bead of H.B Fullers Firesound sealant. The cables projected horizontally 550-mm away from the unexposed face of the wall and approximately 500-mm into the furnace chamber. The cables were supported at nominally 500-mm from the unexposed face of the plasterboard wall.

Specimen 1 failed insulation at 123 minutes on the top of the E-Flex pipe lagging 25-mm from the collar. Specimen 6 failed insulation at 146 minutes on the 16-mm2 power cable 25-mm from the above the collar. Specimen 2 failed insulation at 151 minutes one the collar. Specimen 4 failed insulation at 166 minutes one the plasterboard wall 25-mm above the collar. Specimen 5 failed insulation at 175 minutes one the plasterboard wall 25-mm above the collar. Specimen 3 failed insulation at 180 minutes one the plasterboard wall 25-mm above the collar. All 6 specimens were able to maintain integrity for the 181 minutes duration of the test.

A.8. Summary of test reports

Report	Pen. #	Collar Code	Element	Service	Details	Integrity/ insulation (minutes)
FSP 1990	2	MS50R	2x13mm plasterboard sheets each side of a 64mm steel stud	3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging, 2.5mm² 4C+E round power cable and 20mm Pressure PVC	100% full	-/122/59 (¾-inch insulated copper pair coil pipe)
FSP 1902	5	SNAP 32R	2x13mm plasterboard sheets each side of a 64mm steel stud	5 x Optical Fibres cables in 26.75mm PVC conduit	Partial full	-/181/170
FSP 2049	4	MS70R	120mm concrete slab	3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging, 2.5mm² 3C+E round power cable and 20mm Pressure PVC	100% full Firesound to fill gaps	-/241/162 (electric cable)
FSP 2058	3	MS70R	75mm Hebel PowerPanel	3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging, 2.5mm² 3C+E round power cable and 25mm Pressure PVC	100% full Firesound to fill gaps	-/121/98 (¾-inch insulated copper pair coil pipe)
FSP 2118	1	MS70R	75mm Hebel PowerPanel	50 PN6 PVC		-/121/121
	2	MS70R		50mm Medium Duty Conduit filled with 2x6mm² 3C+E power cables 2x16mm² 3C+E power cables	Conduit 100% full	-/121/121
	3	MS70R		20xCat5e	20% full	-/121/120 (Hebel)
	4	MS70R		100xCat5	100% full	-/121/117 (Hebel)
	5	MS70R		1in copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	100% full	-/121/118 (collar)
	6	MS70R		3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	100% full Firesound to fill gaps	-/121/119 (16-mm² power cables)
FSP 2120	1	MS70R	1x13mm plasterboard sheets each	1in copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	100% full	-/91/78 (plasterboard)

Report	Pen. #	Collar Code	Element	Service	Details	Integrity/ insulation (minutes)
	2	MS70R	side of a 64mm steel stud	50mm Medium Duty Conduit filled with 2x16mm² 3C+E power cables 2x6mm² 3C+E power cables	Conduit 100% full	-/91/77 (collar)
	3	MS70R		20xCat5	20% full	-/91/79 (plasterboard)
	4	MS70R		100xCat5	100% full	-/91/80 (plasterboard)
	5	MS70R		3/8in & 3/4in copper pair coil lagged in 9mm non-F/R lagging, 2.5mm² 3C+E round power cable and 25mm Pressure PVC	100% full Firesound to fill gaps	-/91/83 (plasterboard)
	6	MS70R		3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	100% full Firesound to fill gaps	-/91/91
FSP 2126	1	MS70R	2x13mm plasterboard sheets each side of a 64mm steel stud	1 inch copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	100% full	-/181/123 (E-Flex pipe)
	2	MS70R		50mm Medium Duty Conduit filled with 2x16mm² 3C+E power cables 2x6mm² 3C+E power cables	Conduit 100% full	-/181/151 (Collar)
	3	MS70R		20xCat5	20% full	-/181/180 (plasterboard)
	4	MS70R		100xCat5	100% full	-/181/166 (plasterboard)
	5	MS70R		3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging, 2.5mm² 3C+E round power cable and 25mm Pressure PVC	100% full Firesound to fill gaps	-/181/175 (plasterboard)
	6	MS70R		3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	100% full Firesound to fill gaps	-/181/146 (16-mm² power cable)

Appendix B Analysis of Variations

B.1 Variation to substrate

The proposed construction shall be Snap collars tested in Table 1 and listed in Table 2, and subject to the following variations:

- The wall constructions tested shall vary from that tested to one of the following types as listed in Table 3
- The aperture to aperture spacing in the substrate shall be at least 40mm as shown in Figures 6 and 7

Up to 90 minutes stud lined walls

The proposed wall types consist of stud walls lined with one layer of 13 fire rated plasterboard or 16mm fire rated plasterboard or 10mm FIRECRUNCH board or 2 layers of 7.5mm Multiboard walls.

The test results of services tested in one layer of 13mm Fire rated plasterboard lined system as shown in section A8 are applied to one layer of 16mm fire rated plasterboard lined system as well as one layer of 10mm FIRECRUNCH board lined wall system and 2 layers of 7.5mm Multiboard lined wall.

This is based on the fact that these applied cavity wall systems are all thicker in wall thicknesses than that of the tested 13mm fire rated plasterboard lined wall system in FSP 2120, thus allows the services and the collars to have a slightly longer conduction path, and thus perform slightly better in insulation performance on the unexposed side.

Therefore it is expected that when installed in a thicker lined wall system with the required FRL as shown in Table 3, the collars will also able to allow these various services to maintain insulation for up to the insulation performance of the tested penetration or the wall type, whichever is the lesser.

The ability of this MS70R collar to close off services and prevent hot gas from leaking to the unexposed side to fail cotton pad is demonstrated across various services installed in a 90mm thick wall in FSP 2120 for a minimum of 90 minutes, and a 96mm thick wall in FSP 1990 for a minimum of 180 minutes for smaller 65mm high version of the MS70R called an MS50R.

Therefore it is expected that when installed in a thicker lined wall system with the required FRL as shown in Table 3, the collars will also able to allow these various services to maintain integrity for up to the integrity performance of the tested penetration or the wall type, whichever is the lesser.

With reference to FSP 2120, it's 6 service types all maintain the integrity of 90 minutes, and insulation of at least 60 minutes, with the exception specimen 6 which comprised 3x6mm² 3C+E and 6x16mm² 3C+E power cables, which were able to maintain insulation for up to 90 minutes.

Based on the above discussion, it is expected that the proposed variation will be able to achieve the integrity and insulation performance shown in Table B1 when tested in accordance with AS 1530.4 - 2014 and assessed accordance with AS 4072.1 – 2005.

Confirmation of service spacing

AS 4072.1 -2005 clause 4.9.3 states that "the minimum distance between penetrations in a modular system shall be not less than 40 mm unless otherwise tested in specimen form." It is noted also in clause 1.4.10 which defines a "penetration" as "An aperture through a fire-separating element for the passage of a service or services"

Based on the above, it is considered that AS 4072.1 -2005 Amdt 1 clause 4.9.3 applies to the specimens considered in this assessment. The minimum aperture to aperture spacing of the proposed specimens is 40mm.

However, if the collar flanges are touching each other as shown in Figure 7, the collars will interfere with each other's insulation performance. Therefore, the performance of the penetrations is then dictated by the lowest performing penetration in the proposed substrate as shown in Table B1.

Table B1: Up to 90minutes lined wall systems

Collar spacing	**Services in MS70R collar**	**FRL**			
		Wall ID (Table 3)			
		1	3	4	5
Collar flange min. 40mm apart See Figure 6	3/8in & 3/4in copper pair coil lagged in PE or F/R lagging, 2.5mm² 3C+E round power cable and up to 25mm Pressure PVC pipe	-/60/60	-/90/60	-/90/60	-/90/60
	1 inch copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	-/60/60	-/90/60	-/90/60	-/90/60
	Up to 100 Cat5e cables	-/60/60	-/90/60	-/90/60	-/90/60
	3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	-/60/60	-/90/90	-/90/90	-/90/90
	50mm Medium Duty Conduit filled with 2x6mm² 3C+E power cables, 2x16mm² 3C+E power cables	-/60/60	-/90/60	-/90/60	-/90/60
Collar flange side by side See Figure 7	3/8in & 3/4in copper pair coil lagged in PE or F/R lagging, 2.5mm² 3C+E round power cable and up to 25mm Pressure PVC pipe	-/60/60	-/90/60	-/90/60	-/90/60
	1 inch copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	-/60/60	-/90/60	-/90/60	-/90/60
	Up to 100 Cat5e cables	-/60/60	-/90/60	-/90/60	-/90/60
	3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	-/60/60	-/90/60	-/90/60	-/90/60
	50mm Medium Duty Conduit filled with 2x6mm² 3C+E power cables, 2x16mm² 3C+E power cables	-/60/60	-/90/60	-/90/60	-/90/60

Up to 120 and 180 minutes stud lined walls

The proposed wall types consist of stud walls lined with two layers of 13 fire rated plasterboard or 16mm fire rated plasterboard walls and minimum 116mm thick concrete and masonry walls.

The test results of services tested in 2 layers of 13mm Fire rated plasterboard lined system as shown in section A8 are applied to 2 layers of 13mm 16mm fire rated plasterboard lined system.

This is based on the fact that the applied cavity wall system is thicker in wall thicknesses than that of the tested 13mm fire rated plasterboard lined wall in FSP 2126, thus allows the services and the collars to have a slightly longer conduction path, and thus perform slightly better in insulation performance on the unexposed side.

Therefore it is expected that when installed in a thicker lined wall system with the required FRL as shown in Table 3, the collars will also able to allow these various services to maintain insulation for up to the insulation performance of the tested penetration or the wall type, whichever is the lesser.

The ability of this MS70R collar to close off services and prevent hot gas from leaking to the unexposed side to fail cotton pad is demonstrated across various services installed in a 116 mm thick wall in FSP 2126 for a minimum of 180 minutes.

Therefore it is expected that when installed in a thicker lined wall system with the required FRL as shown in Table 3, the collars will also able to allow these various services to maintain integrity for up to the integrity performance of the tested penetration or the wall type, whichever is the lesser.

With reference to FSP 2126, it's 6 service types all maintain an integrity of 180 minutes and insulation of at least 120 minutes. Some of the penetrations failed insulation on the actual services or the collars. These penetration's insulation performance remains the same when installed onto a thicker wall.

However, with penetrations that failed on the wall substrate, with the maximum shortfall of 14 minutes, it was found that their services were able to maintain insulation at 180 minutes. Therefore, by having 2 layers of 16mm fire rated plasterboard on each side of the wall, which results in a 12mm increase in fire rated plasterboard material compared to the tested system, it is expected that this will allow the wall substrates to also maintain insulation for at least another 15 minutes.

The test results of services tested in 2 layers of 13mm fire rated plasterboard lined system which has a total thickness of 116mm as shown in section A8 are also applicable to minimum 116mm thick concrete and masonry walls since it is expected that the proposed masonry and concrete wall will act to cool the penetration temperature on the unexposed side due to its heat sink effect.

Based on the above discussion, it is expected that the proposed variation will be able to achieve the integrity and insulation performance shown in Table B2 when tested in accordance with AS 1530.4 - 2014 and assessed accordance with AS 4072.1 – 2005.

Table B2: Up to 120 and 180 minutes lined wall systems

Collar spacing	**Service in MS70R collar**	**FRL**	
		Wall ID Table 3	
		7	11
Collar flange min. 40mm apart See Figure 6	3/8in & 3/4in copper pair coil lagged in PE or F/R lagging, 2.5mm² 3C+E round power cable and up to 25mm Pressure PVC pipe	-/120/120	-/180/180
	1 inch copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	-/120/120	-/180/120
	Up to 100 Cat5e cables	-/120/120	-/180/180
	3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	-/120/120	-/180/180

Collar spacing	Service in MS70R collar	FRL	
		Wall ID Table 3	
		7	11
	50mm Medium Duty Conduit filled with 2x6mm² 3C+E power cables, 2x16mm² 3C+E power cables	-/120/120	-/180/120
Collar flange side by side See Figure 7	3/8in & 3/4in copper pair coil lagged in PE or F/R lagging, 2.5mm² 3C+E round power cable and up to 25mm Pressure PVC pipe	-/120/120	-/180/120
	1 inch copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	-/120/120	-/180/120
	Up to 100 Cat5e cables	-/120/120	-/180/120
	3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	-/120/120	-/180/120
	50mm Medium Duty Conduit filled with 2x6mm² 3C+E power cables, 2x16mm² 3C+E power cables	-/120/120	-/180/120

Solid wall systems

The proposed wall types consist of solid walls made from either concrete, masonry, Hebel or Speedpanel.

The test results of services tested in 75mm Hebel walls with an FRL of -/90/90 as shown in section A8 are applied to 75mm thick Hebel walls with an FRL of -/120/120 as well as to 78mm Speedpanel and 90mm concrete/masonry walls.

All of the 6 services in FSP 2118, as well as specimen 3 in FSP 2058, were able to maintain integrity for 120 minutes when installed on a 75mm thick Hebel wall.

The proposed wall types are either the same thickness or thicker than that of the tested 75mm Hebel. They are also of greater density than the tested 75mm Hebel which has a nominal dry density of 510 kg/m^3.

Therefore, it is expected that these wall types will provide a greater heat sink effect than the tested Hebel panel, to allow the penetration temperature on the unexposed side to be lower than that tested.

Also, FSP 2118 specimen 4, which comprised 100 Cat 5e cables, failed insulation on the Hebel panel, with an FRL of -90/90, at 117 minutes. It is expected that when installed onto substrates with a higher insulation performance of 120 minutes, this specimen will maintain insulation for at least 120 minutes.

The proposed Speedpanel, when installed with 13mm plasterboard patch on each side, would prevent venting from the Speedpanel core from affecting the performance of the collar since the patch provides a flat surface for the collars. The presence of the patch would provide slightly more insulation performance to the wall substrate area of the penetration.

A 50mm PVC conduit was tested empty in FSP 2118 specimen 1, it demonstrated that the MS70R collars can close off the PVC pipes and prevent integrity and insulation failure for at least 120 minutes. With reference to FSP 2126 specimen 2, which comprised a 50mm PVC conduit filled with cable services and installed in a section of plasterboard wall with an FRL of -/120/120, it was also able to maintain integrity for 181 minutes and insulation of 151 minutes.

The significance of FSP 2126 specimen 2 is that it demonstrated that even when the conduit was filled with irregular cable services the MS70R collar was able to close off all gaps around the conduit and the cable services to prevent gap formation of 180 minutes. It is expected that without these irregular cable Services, the collar would also be able to completely close off the conduit for a period of up to 180 minutes such that it maintains integrity for 180 minutes.

Therefore, it is expected that when installed onto a plasterboard wall with an FRL of -/180/180, the empty PVC conduit will also be able to maintain integrity for at least 180 minutes and insulation for at least 120 minutes.

As discussed previously, it is expected that when installed in a thicker wall system with the required FRL as shown in Table 3, the collars will also able to allow these various services to maintain integrity and insulation for up to the performance of the tested penetration or the wall type, whichever is the lesser.

Based on the above discussion, it is expected that the proposed variation will be able to achieve the integrity and insulation performance shown in Table B3 when tested in accordance with AS 1530.4 - 2014 and assessed accordance with AS 4072.1 – 2005.

Table B3: Solid wall systems

Collar spacing	**Service in MS70R collar**	**FRL**			
		Wall ID (Table 3)			
		2	6	8	9
Collar flange min. 40mm apart See Figure 6	3/8in & 3/4in copper pair coil lagged in PE or F/R lagging, 2.5mm² 3C+E round power cable and up to 25mm Pressure PVC pipe	-/60/60	-/90/90	-/120/90	-/120/90
	1 inch copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	-/60/60	-/90/90	-/120/90	-/120/90
	Up to 100 Cat5e cables	-/60/60	-/90/90	-/120/120	-/120/120
	Empty 50mm PVC conduit	-/60/60	-/90/90	-/120/120	-/120/120
	3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	-/60/60	-/90/90	-/120/90	-/120/90
	50mm Medium Duty Conduit filled with 2x6mm² 3C+E power cables, 2x16mm² 3C+E power cables	-/60/60	-/90/90	-/120/120	-/120/120
Collar flange side by side See Figure 7	3/8in & 3/4in copper pair coil lagged in PE or F/R lagging, 2.5mm² 3C+E round power cable and up to 25mm Pressure PVC pipe	-/60/60	-/90/90	-/120/90	-/120/90
	1 inch copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	-/60/60	-/90/90	-/120/90	-/120/90
	Up to 100 Cat5e cables	-/60/60	-/90/90	-/120/90	-/120/90
	Empty 50mm PVC conduit	-/60/60	-/90/90	-/120/90	-/120/90
	3x6mm² 3C+E power cables 6x16mm² 3C+E power cables	-/60/60	-/90/90	-/120/90	-/120/90
	50mm Medium Duty Conduit filled with 2x6mm² 3C+E power cables, 2x16mm² 3C+E power cables	-/60/60	-/90/90	-/120/90	-/120/90

B.2 Variation to PVC conduits

The proposed variation comprises the inclusion of 20mm to 50mm PVC conduits as shown in Table 4 across all wall types as listed in Table 3, filled with RG6 cables, Cat5e cables, fibre optic cables as well as power cables as listed in Table 4 to 0 - 100% fullness of the conduit.

Empty PVC conduit

FSP 2118 specimen 1 demonstrated that the MS70R collar can close off an empty 50mm diameter PVC conduit with a wall thickness of 1.84mm and allow the specimen to maintain integrity and insulation for at least 120 minutes when installed in a 75mm thick Hebel panel wall.

The pipe temperature had stabilised and plateaued at around 75 minutes into the test, which demonstrated the full closure of the collar around the plastic pipe on the exposed side. It is expected that further 28% furnace exposure from 120 minutes to 180 minutes duration will not introduce gaps in the activated collar on the exposure side. Even if gaps were introduced in the exposure side, the furnace gas that leaks through will then activate the collar on the exposure side such that the specimen will be able to maintain integrity for up to 180 minutes.

The tested specimen was installed in a 75mm thick Hebel wall, while the proposed wall types are all thicker than 75mm. Therefore, it is expected that the pipe temperature on the unexposed side will not be any hotter than that tested, allowing the specimen to be able to maintain insulation in these wall types for at least 120 minutes.

The small variation in the wall thicknesses of the proposed 50mm pipe is also not expected to detrimentally affect the performance of the specimen. Further confidence in the MS70R to close off the proposed maximum PVC thickness of 2.85mm is found in FSP 2118 specimen 2 that demonstrated that the MS70R collar was able to close off a fully filled 50mm PVC conduit with a wall thickness of 2.71mm without integrity failure for 120 minutes. The proposed 20mm, 25mm, 32mm and 40mm PVC conduits pipe, with wall thickness similar to that tested in FSP 2118 specimen 1, is expected to behave similarly as the 50mm pipe.

Based on the above, it is expected that the proposed empty 20mm to 50mm PVC conduits as shown in Table 4 when installed across all wall types as listed in Table 3, will be able to achieve integrity of up to 180 minutes and insulation of up to 120 minutes.

Partial to full fill of conduit

With reference to the PVC conduits tested fully of power cables in FSP 2126 Specimen 2, it demonstrated that the MS70R collars can close off the PVC conduit when fully filled with large cable services and prevent integrity failure for at least 181 minutes. It also demonstrated that with large cable services in the conduit, the maximum insulation performance of the specimen is at least 120 minutes.

The proposed reduction in the number of power cable services will only improve the insulation performance of the penetration as there will be less copper content to conduct heat to the unexposed side.

With reference to the MS70R collar tested partially and fully of smaller CAT5e cables in FSP 2126 Specimen 3 and 4 respectively, they demonstrated that the MS70R collars can close off the PVC conduit partially and when fully filled with CAT5e cables, and prevent integrity failure for at least 181 minutes. It also demonstrated that with many cable services in the collar, the maximum insulation performance of the specimen is at least 120 minutes. Therefore, when these cables are inside a PVC conduit, it is expected that they will achieve similar performances to when they were just in the collar without conduits.

The proposed reduction in the number of CAT5e cables from the minimum 20 tested, will only improve the integrity performance of the penetration as there will be less plastic content to induce flaming on the unexposed side.

The proposed RG6 cables are slightly larger to the CAT5e cables, with a similar amount of plastic sheathing, and contains a single 1mm diameter copper core instead of 8 x 0.5mm copper core. Therefore, when the RG6 cables substitute the tested CAT 5e cables in a PVC conduit and protected by MS70R collar, there will be less conductive material and a similar amount of plastic component.

It is therefore expected that RG6 cables will perform similar or better in insulation than CAT5e cables due to its lower conductor content.

These 3 services were installed in 116mm thick plasterboard lined walls. The change in wall thickness and wall types will affect the insulation performance of the penetrations.

With reference to FSP 2120 specimen 2 which comprised power cables in 50mm PVC conduit installed in a 90mm stud wall, its insulation failure on the collar at 77 minutes demonstrated that in thinner stud walls, collar failure can occur before cable failure. Therefore, the insulation performance of the proposed partially or fully filled PVC conduit in these wall types are limited to 60 minutes.

With reference to FSP 2126 specimen 2 which comprised power cables in 50mm PVC conduit installed in a 116mm stud wall, its insulation failure on the collar at 151 minutes demonstrated that in thicker stud walls, collar failure can also occur before cable failure. Therefore, the insulation performance of the proposed partially to fully filled PVC conduit in these wall types are limited to 120 minutes.

With reference to FSP 2118 specimen 2 which comprised power cables in 50mm PVC conduit installed in a 75mm thick Hebel wall, it was able to maintain insulation for 121 minutes. This insulation performance is thus applied to the proposed solid wall types of equal or greater thickness.

With reference to FSP 1902 specimen 5, which comprised five optical fibre cables partially filling a 20mm PVC conduit penetrated a 116mm thick plasterboard line wall and protected by a 32R Retrofit collar. The penetration was able to maintain integrity for 181 minutes duration of the test and failed insulation on the plasterboard wall at 170 minutes.

The ability of the MS70R collar to close off large and small services in PVC pipes are demonstrated in the referenced tests summarised in Section A8. It is expected that MS70R would also be able to close off these fibre optic cables when they partially or fully fill the PVC conduit such that it won't fail integrity for up to 180 minutes.

Though FSP 1902 specimen 5 contains a different collar, the significance of this specimen's low PVC temperature on the unexposed side is that it shows the fibre optic cables on the fireside been mostly melted away leaving little material for conduction of heat to the unexposed side. Therefore, it is expected that when protected by MS70R collars, it will also able to maintain insulation for up to 120 minutes in a 116mm thick plasterboard lined wall.

As discussed previously, it is expected that when installed in a wall system with the required FRL as shown in Table 3, the MS70R collar will also able to allow 0% to fully filled PVC conduits containing Cat5e cables, fibre optic cables as well as power cables, to maintain integrity and insulation for up to the performance of the tested penetration or the wall type, whichever is the lesser.

Based on the above discussion, it is expected that the proposed variation will be able to achieve the integrity and insulation performance shown in Table B4 when tested in accordance with AS 1530.4 - 2014 and assessed accordance with AS 4072.1 – 2005.

Table B4: PVC pipes 0-100% filled

Collar spacing	Service in MS70R collar	Variation to services	Collar/conduit fill	FRL										
				1	2	3	4	5	6	7	8	9	10	11
See Figure 6	20mm to 50 PVC pipe	See Table 4	0 - 100 %	-/60/60	-/60/60	-/90/60	-/90/60	-/90/60	-/90/90	-/120/120	-/120/120	-/120/120	-/120/120	-/180/120
See Figure 7				-/60/60	-/60/60	-/90/60	-/90/60	-/90/60	-/90/90	-/120/120	-/120/90	-/120/90	-/120/120	-/180/120

B.3 Power and Cat 5e cables in Collar

The proposed variation comprises MS70R collar, either empty, partially or when fully filled with Cat 5e cables, fibre optic cables and power cables, and RG6 cables.

When the collar is empty, there's a potential for furnace gas to escape the un-activated collar to ignite cotton pad. However, from FSP 2118 specimen 1 which comprised an empty 50mm diameter PVC conduit, its collar was able to close around 4 minutes to prevent smoke from exiting the pipe. Before 4 minutes, the low temperature of the furnace gas is not enough to ignite a cotton pad. Therefore, it is expected that the empty MS70R collar will be able to maintain integrity and insulation for up to 180 minutes.

With reference to Table B5, these results demonstrated that when MS70R collars are partially or fully filled with Cat 5e cables across 3 wall types, the integrity performance of the penetrations was not affected by how much the collar is filled. The penetrations' cable insulation performance however does differ in that more cables reduce the insulation performance of the system. However, since the maximum number of 100 20xCat5e cables were tested, their insulation performance is then set as the upper limit for this type of cable.

Table B5: Collar partially and when fully filled

Report	Pen. #	Collar Code	Element	Service	Details	Integrity/ insulation (minutes.)
FSP 2118	3	MS70R	75mm Hebel PowerPanel	20xCat5e	20% full	-/121/120 (Hebel)
FSP 2118	4	MS70R	75mm Hebel PowerPanel	100xCat5	100% full	-/121/117 (Hebel)
FSP 2120	3	MS70R	1x13mm plasterboard sheets each side of a 64mm steel stud	20xCat5e	20% full	-/91/79 (plasterboard)
FSP 2120	4	MS70R	1x13mm plasterboard sheets each side of a 64mm steel stud	100xCat5	100% full	-/91/80 (plasterboard)
FSP 2126	3	MS70R	2x13mm plasterboard sheets each side of a 64mm steel stud	20xCat5e	20% full	-/181/180 (plasterboard)
FSP 2126	4	MS70R	2x13mm plasterboard sheets each side of a 64mm steel stud	100xCat5	100% full	-/181/166 (plasterboard)

The above observations can also be applied to power cables which when reduced in number, will improve the overall insulation performance of the system without reducing the integrity performance.

The proposed variation also includes fibre optic cables. As discussed in Section B2, is expected that these cables will be less conductive than the copper cored CAT5e cables discussed above, and therefore it is expected that they will able to maintain insulation for at least up to 120 minutes.

The proposed RG6 cables are slightly larger to the CAT5e cables, with a similar amount of plastic sheathing, and contains a single 1mm diameter copper core instead of 8 x 0.5mm copper core. Therefore, when the RG6 cables substitute the tested CAT 5e cables in an MS70R collar, there will be less conductive material and a similar amount of plastic component. It is therefore expected that RG6 cables will perform similar or better in insulation than CAT5e cables due to its lower conductor content.

As discussed previously, the ability of the MS70R collar to close off large and small services without PVC conduit is demonstrated in the referenced tests summarised in Section A8. It is expected that MS70R would also be able to close off these fibre optic cables when they partially or fully fill the MS70R collar such that it won't fail integrity for up to 180 minutes.

Based on the above discussion, it is expected that the proposed variation will not detrimentally affect the integrity and insulation performance of the services shown in Tables B1, B2, and B3 when tested in accordance with AS 1530.4 -2014, and assessed accordance with AS 4072.1 – 2005.

B.4 Lagged pipes

The proposed variation comprises copper and steel pipe of various sizes with either PE or F/R lagging of various thicknesses as shown in Table B4.

Table B6: relevant test data for lagged copper pipes

Report	Pen. #	Collar Code	Element	Service	Integrity/ insulation (min.)	Maximum temperature rise on copper pipe
FSP 2118	5	MS70R	75mm Hebel PowerPanel	1 inch(DN25B) copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	-/121/118 (collar)	72°C rise at 120 minutes
FSP 2120	1	MS70R	1x13mm plasterboard sheets each side of a 64mm steel stud	1 inch copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	-/91/78 (plasterboard)	136°C rise at 90 minutes
FSP 2126	1	MS70R	2x13mm plasterboard sheets each side of a 64mm steel stud	1 inch(DN25B) copper pipe with 19mm F/R lagging (F/R Armaflex) and 2.5mm² 3C TPS flat power cable	-/181/123 (insulated pipe)	156°C rise at 120 minutes
FSP 2049	4	MS70R	120mm concrete slab	3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging, 2.5mm² 3C+E round power cable and 20mm Pressure PVC pipe	-/241/162 (electric cable)	104°C rise at 120 minutes
FSP 2058	3	MS70R	75mm Hebel PowerPanel	3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging, 2.5mm² 3C+E round power cable and 25mm Pressure PVC pipe	-/121/98 (¾-inch insulated copper pair coil pipe)	175°C rise at 90 minutes
FSP 2120	5	MS70R	1x13mm plasterboard sheets each side of a 64mm steel stud	3/8in & 3/4in copper pair coil lagged in 9mm non-F/R lagging, 2.5mm² 3C+E round power cable and 25mm Pressure PVC pipe	-/91/83 (plasterboard)	34°C rise at 90 minutes
FSP 2126	5	MS70R	2x13mm plasterboard sheets each side of a 64mm steel stud	3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging, 2.5mm² 3C+E round power cable and 25mm Pressure PVC	-/181/175 (plasterboard)	59°C rise at 120 minutes 95°C rise at 180 minutes

Lagged copper and steel pipes

With reference to Table B6, the temperature measurement on FSP 2118 specimen 5, the lagging is relatively cool compared with the rest of the specimen. The oscillation behaviour of the temperature measured by the thermocouples on the lagging shows the heating behaviour of the F/R lagging after 50 minutes. When it swells, there is a drop in measured temperature due to the thermocouple been further away from the copper pipe. When it then melts, the thermocouple is closer to the pipe, and so the measured temperature increases. This swelling-melting behaviour of the F/R lagging was also observed in FSP 2126 specimen 1.

The significance of these tests demonstrated that the F/R lagging on the copper pipe can sustain the heat from a hot copper pipe for up to 181 minutes without causing flaming.

Also, the swelling and melting behaviour of the F/R lagging would allow a thicker F/R lagging to provide more thermo-insulation to the pipe such that during its melting phase, the temperature measured on a thicker F/R lagged pipe would be lower than that of a thinner F/R lagged pipe.

FSP 2118 Specimen 5 and FSP 2126 Specimen 1 demonstrated that pipes up to 1 inch with at least 19mm F/R lagging can maintain insulation for up to 120 minutes with some margin.

It is expected that the larger 1 inch copper pipes are hotter than the smaller ¾ inch copper pipes due to it having more cross-sectional conduction area.

Based on the above, the proposed 3/4 inch and 1 inch copper pipe lagged with 25mm F/R lagging would perform better in insulation performance than the tested 1 inch lagged copper pipe with 19mm F/R lagging as tested in FSP 2126 Specimen 1, and thus able to maintain insulation for at least 120 minutes.

With reference to Table B6, in FSP 2126 specimen 5, the 3/8in & 3/4in copper pair coil lagged in 10mm non-F/R lagging was only measuring a maximum temperature rise of 95°C at 180 minutes into the test when installed in a 116mm plasterboard system. With reference to Table B6, in FSP 2058 specimen 5, the 3/8 and 3/4 inch copper pair coil lagged in 10mm non-F/R lagging was only measuring a maximum temperature of 175°C at 90 minutes into the test when installed in a 116mm plasterboard system.

The significance of these tests demonstrated that the no F/R PE lagging on the copper pipe can sustain the heat from a hot copper pipe for up to 181 minutes without causing flaming while maintaining the largest 3/4 copper pipe insulation for up to 180 minutes. The photographic records of FSP 2126 specimen 5 and FSP 2058 specimen 5 show that the PE lagging softens and disintegrate when heated. Therefore, by having a thicker PE form.

This softening and disintegrating behaviour of the PE lagging would allow a thicker PE lagging to provide more thermo-insulation to the pipe such that during its softening phase, the temperature measured on a thicker PE lagged pipe would be lower than that of a thinner PE lagged pipe. It is expected that the larger 3/4 inch copper pipes are hotter than the smaller 3/8 and 1/4 inch copper pipes due to it having a larger cross-sectional conduction area.

Confidence in the 1mm reduction in PE thickness for the smaller 3/8 and 1/4 inch pipe is provided by the large 85°C margin in insulation performance of the larger ¾ inch copper pipe.

Based on the above, the proposed 1/4, 3/8 and 3/4 inch copper pipe lagged with at least 9mm PE foam lagging would perform the same or better in insulation performance than the tested 3/4 inch lagged copper pipe with 9mm PE lagging as tested in FSP 2126 Specimen 5, and thus able to maintain insulation for at least 180 minutes.

A comparison of the heated behaviour of the PE foam lagging and the F/R lagging would see F/R lagging of the same thickness perform better in insulation performance than that of PE lagging as the F/R lagging tend to swell and melt rather than disintegrate. Therefore, it is expected that for smaller 3/8 and 1/4 inch copper pipe, a 9mm thick F/R lagging would perform the same in insulation performance as the tested 3/4 inch lagged copper pipe with 9mm PE lagging as tested in FSP 2126 Specimen 5, and thus able to maintain insulation for at least 180 minutes.

It is expected that for medium size 3/8 and 3/4 inch copper pipe the proposed 25mm thick F/R lagging would perform the same in insulation performance as the tested 3/4 inch lagged copper pipe with 9mm PE lagging as tested in FSP 2126 Specimen 5, and thus able to maintain insulation for at least 180 minutes. The proposed steel pipe is a poorer conductor compared to the tested copper pipe, and so is expected to perform better in insulation performance than the copper pipe discussed above.

Based on the above discussion, it is expected that the proposed variation will not detrimentally affect the integrity and insulation performance for copper and steel pipes shown in Tables B1, B2, and B3 when tested in accordance with AS 1530.4 -2014, and assessed accordance with AS 4072.1 – 2005.

B.5 Variation to collar fixing

The proposed construction includes the MS70R fire collars fixed to various substrates using these fixings listed in Table 5. With reference to test data in Appendix A, the tested MS70R collars were fixed to various substrates as summarised in Table B7 below.

Table B7: relevant test data for fixings

Report Reference	Substrate	Fixing	Fireside behaviour
FSP 1990	Double layered plasterboard lined stud wall	M4 expandable steel anchors	Held on
FSP 2049	Concrete slab	5-mm x 35-mm concrete screws	Held on
FSP 2058	Hebel Panel	14-10 65-mm hex head screws	Held on
FSP 2118	Hebel Panel	14-10 65-mm hex head screws	Held on
FSP 2120	Single layered plasterboard lined stud wall	M4 expandable steel anchors	Some fell off, some held on
FSP 2126	Double layered plasterboard lined stud wall	M4 expandable steel anchors	Some fell off, some held on

Table B7 shows that the metal expandable steel anchors are effective fixings for holding MS70R collar in place on single or double layered plasterboard wall systems. Even when the collars fell off, the activated intumescent in the exposed and unexposed side collars were able to provide sufficient seal to the hole in the wall such that there was no flaming observed on the unexposed side in any of the tests.

The proposed FIRECRUNCH and Multiboard lined with metal expandable steel anchors is expected to also be able to behave similarly to the plasterboard wall in that they are both stud lined wall systems. Table B7 shows that the 14-10 65mm Hex Head Screws are effective fixings for holding MS70R collar in place on Hebel wall systems such that no collar fell off. The proposed Speedpanel Wall with 14-10 65mm Hex Head Screws are expected to also be able to behave similarly to the Hebel wall in that they are both aerated core wall systems. Table B7 shows that the 5-mm x 35-mm concrete screws are effective fixings for holding MS70R collar in place on concrete slab such that the collar did fell off.

The proposed concrete and masonry wall with 5mm x 30mm Concrete Screw Bolts is expected to also be able to behave similarly to the concrete slab in that they are solid ceramic substates.

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 AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

B.6 Variation to sealant

The proposed variation comprises the Snap collars tested in Table 2, and subject to the following variations:

- Inclusion of Firesound sealant to fill gaps when cable and services are protected by MS70R collar without PVC conduits.
- Inclusion of sealants as listed in Table 7

With reference to Section A8, the presence of Fuller Firesound sealant which filled the gaps between cables and pair coils that penetrated the MS70R collar did not cause flaming for 180 minutes.

It is expected that when this sealant is applied to the gaps of other cable services that are protected by MS70R collar without PVC conduits, they will not detrimentally affect the integrity performance of the penetration.

The presence of sealant will act to prevent any venting of hot gas from the furnace side to the unexposed side, and thus it can slightly improve the insulation performance of the penetrations.

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 AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

B.7 Mix of services

The proposed variation comprises the Snap collars tested in Table 2, and subject to the following variations:

- Inclusion of mix services form Tables 4 and 5 in MS70R collar

The proposed construction comprises mixing services from Table 4 and Table 5 into the MS70R collar when installed within one wall type.

In the referenced tests listed in Appendix A, none of the services failed integrity. It is expected that the mixing of the services will not detrimentally affect the integrity of these services.

The mode of failure for these services is only insulation failures. When the services are a mix, it is expected that the lowest performing services will determine the performance of the penetration.

Based on the above discussion it is considered the proposed variation will not detrimentally affect the integrity performance of the tested service penetrations, and will decrease the performance of the service penetration to the lowest performing service in the MS70R collar as discussed above if tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

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