

FIRE ASSESSMENT REPORT

FAR 3933 ISSUE 4

FIRE RESISTANCE OF SNAP FIRE SYSTEMS PTY LTD RETRO-FIT COLLARS WITH A VARIETY OF PIPE SIZES AND MATERIAL TYPES INSTALLED IN CONCRETE SLAB FLOORS

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ASSESSMENT OBJECTIVE

This assessment report considers the fire resistance of SNAP Retro-fit collars installed in the soffit of a concrete floor slab when tested in accordance with AS 1530.4:2014 with reference to AS 4072.1 – 2005.

CONCLUSION

It is considered that the SNAP Fire Systems Retro-fit collar pipe penetration systems given in Table 14 would achieve up to the fire resistance listed in terms of the Integrity and Insulation in a floor slab with an FRL of up to 240/240/240 when tested in accordance with AS 1530.4:2014 with reference to AS 4072.1 – 2005.

For a different thickness of floor slab with a lower FRL the penetration system FRL is lowered to match the slab FRL.

Table 15 gives the required thickness of concrete to achieve a required fire resistance level (FRL).

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1. INTRODUCTION

This report gives BRANZ's assessment on the fire resistance of SNAP Retro-fit collars installed in the soffit of a concrete floor slab when tested in accordance with AS 1530.4:2014 with reference to AS 4072.1 – 2005 including amendment one.

2. BACKGROUND

2.1 BRANZ Fire Resistance Test FP 4640

In BRANZ pilot fire resistance test FP 4640 eight specimens were reported consisting of a mixture of PVC-U DWV and HDPE PE80/100 plastic pipes and their sealing systems penetrating a nominal 150 mm thick concrete floor. The specimens were tested in accordance with AS 1530.4-2005.

Six of the sealing systems consisted of SNAP Retro-fit collars with intumescent wraps on the inner face. The collars with the prefix HP and LP included three equally spaced spring pockets located around the perimeter of the collar assembly. The steel collars were secured to the soffit of the concrete floor with masonry anchors. Table 1 shows the test results for the Retro-fit collars.

Table 1: Test Result FP 4640

No.	Collar Designation	Pipe Designation	Integrity (Minutes)	Insulation (Minutes)	FRL
2	HP100R	100 PVC-U SC DWV* (With Elbow socket in collar)	245NF	245NF	-/240/240
3	110R	50 PVC-U DWV	245NF	245NF	-/240/240
4	63R	40 PVC-U DWV (With Elbow socket in collar)	245NF	245NF	-/240/240
7	LP50R	40 PVC-U DWV	245NF	245NF	-/240/240
9	63R	100 PVC-U SC DWV*	245NF	245NF	-/240/240
10	110R	110 mm x 4.3 mm PE100 SDR 26	245NF	245NF	-/240/240

NF = No failure for the duration of the test.

2.2 BRANZ Fire Resistance Test FP 4428

In BRANZ pilot fire resistance test FP 4428 the type B collar reported as specimen No. 2 consisted of a nominal 100 mm PVC-U DWV floorwaste with an ABS floor grate and a Retro-Issue fit collar assembly identified as type B. The service penetrated a nominal 150 mm thick concrete floor. The specimen was tested in accordance with AS 1530.4-2005.

The type B collar consisted of SNAP Retro-fit collars with intumescent wraps on the inner face. The steel collars were secured to the soffit of the concrete floor with masonry anchors.

The specimen achieved a fire resistance of 245 minutes integrity and insulation without failure giving an FRL -/240/240.

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2.3 BRANZ Assessment Report FAR 3722

BRANZ's assessment report FAR 3722 concluded that the SNAP LP100R Retro-fit collar is for all intent and purposes the same collar assembly as the type B collar tested as specimen No.2 in FP 4428. The assessment further considered that the SNAP LP100R collar fitted to the exposed face of a concrete floor slab protecting a nominal 100 mm PVC-U DWV pipe would not prejudice the integrity or insulation criteria before at least 240 minutes when tested in accordance with AS 1530.4-2005.

2.4 BRANZ Fire Resistance Test FP 4837

In BRANZ pilot fire resistance test FP 4837 nine specimens were reported consisting of a mixture of PVC-U DWV and HDPE PE80/100 plastic pipes and their sealing systems penetrating a nominal 150 mm thick concrete floor. The specimens were tested in accordance with AS 1530.4-2005.

Six of the sealing systems consisted of SNAP Retro-fit collars with intumescent wraps on the inner face. The steel collars were secured to the soffit of the concrete floor with masonry anchors. Table 2 shows the test results for the Retro-fit collars.

Table 2: Test Result FP 4837

No.	Collar Designation	Pipe Designation	Integrity (Minutes)	Insulation (Minutes)	FRL
1	110R	110 mm x 4.3 mm PE100 SDR 26	245NF	245NF	-/240/240
2	65-80R	80 PVC-U DWV	245NF	245NF	-/240/240
3	50R	40 PVC-U DWV	245NF	245NF	-/240/240
8	50R	40 mm x 3 mm PE80 S12.5	245NF	245NF	-/240/240
9	65-80R	65 PVC-U DWV	245NF	245NF	-/240/240
10	50R	40 PVC-U DWV (With Elbow socket in collar)	245NF	245NF	-/240/240

2.5 CSIRO Fire Resistance Test FSP 1146

In CSIRO fire resistance test FSP 1146 four specimens consisting of HDPE pipes and their sealing systems through a nominal 150 mm thick concrete floor slab, were tested in accordance with AS 1530.4-2005.

Two of the specimen sealing systems consisted of SNAP Retro-fit Fireshield collars designation FS2S50HFW, new designation LP50R, with intumescent wraps on the inner face and fibreglass liners. The collars included three equally spaced spring pockets located around the perimeter of the collar assembly. The steel collars were secured to the soffit of the concrete floor with masonry anchors.

Table 3 shows the test results for the Retro-fit collars. The specimens included a floor grate and trap with the socket of the trap within the body of the collar.

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Table 3: Test Result FSP 1146

No.	Collar Designation	Pipe Designation	Integrity (Minutes)	Insulation (Minutes)	FRL
A	FS2S50HFW (LP50R)	50 mm HDPE PE80	182NF	182NF	-/180/180
B	FS2S50HFW (LP50R)	50 mm HDPE Silent Pipe	182NF	182NF	-/180/180

2.6 CSIRO Fire Resistance Test FSP 2174

In CSIRO fire resistance test FSP 2174 seven specimens consisting of Polypropylene, PVC-U and PE-Xa pipes and their sealing systems, through a nominal 150 mm thick concrete floor slab, were tested in accordance with AS 1530.4:2014.

Two of the sealing systems consisted of SNAP Retro-fit collars with intumescent wraps on the inner face within a steel casing. The steel collar was secured to the soffit of the concrete floor via mounting brackets using concrete screw bolts. Table 4 shows the test results for the Retro-fit collars.

Table 4: Test Result FSP 2174

No.	Collar Designation	Pipe Designation	Integrity (Minutes)	Insulation (Minutes)	FRL
2	SNAP 110R Retro-fit	110 mm Valsir Triplus polypropylene	187	188	-/180/180
6	SNAP 50R Retro-fit	40 mm Valsir Triplus polypropylene	241NF	241NF	-/240/180

2.7 CSIRO Fire Resistance Test FSP 2271

In CSIRO fire resistance test FSP 2271 four specimens consisting of Polypropylene and PVC-U pipes and their sealing systems, through a nominal 150 mm thick concrete floor slab, were tested in accordance with AS 1530.4:2014.

One of the sealing systems consisted of SNAP High Profile Retro-fit collars with intumescent wraps on the inner face within a steel casing. The steel collar was secured to the soffit of the concrete floor via mounting brackets using concrete screw bolts. Table 5 shows the test results for the High Profile Retro-fit collar.

Table 5: Test Result FSP 2271

No.	Collar Designation	Pipe Designation	Integrity (Minutes)	Insulation (Minutes)	FRL
3	SNAP 150R High Profile Retro-fit	160 mm Valsir Triplus polypropylene	241NF	241NF	-/240/180

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3. DISCUSSION

3.1 AS 1530.4-2005 vs 2014

In BRANZ fire resistance tests FP 4640, FP 4428 and FP 4837 and CSIRO fire resistance test FSP 1146 the specimens were tested in accordance with fire resistance test standard AS 1530.4–2005. A comparison has been made between this version of the test standard and the current AS 1530.4:2014. With respect to the fire resistance testing of penetrations there is no significant difference between the two versions of the test standard and hence the tested specimen would be expected to achieve the same result if tested in accordance with AS 1530.4:2014.

3.2 SNAP Retro-fit Fire Collars

The SNAP Retro-fit fire collars are designed to be installed prior to the pipe being installed or split onsite and fitted around in-situ pipes. They are fitted to the soffit of the concrete floor slab that the pipe passes through.

There are two types of Retro-fit collars used for floor penetrations. One type is identified with the prefix LP or HP meaning low profile and high profile followed by the nominal size of the collar and suffix R. These collars include three equally spaced spring pockets around the perimeter of the collar with stainless steel springs located inside. The springs are held closed by nylon thermal links.

The other type of Retro-fit collar does not include the spring mechanism and are identified by the nominal size and suffix R. Both types of collars consist of a lipped steel sleeve and contain one, two or three layers of intumescent with a layer of stainless steel mesh wire measuring 0.15 mm thick with 30 squares per inch sandwiched between the layers where there are multiple layers of intumescent, or where only one layer of intumescent is used between the intumescent sleeve and the body of the collar. The thickness, width and number of layers of intumescent within the collar vary depending on the collar specification.

On exposure to fire the intumescent material activates to close off the fire exposed end of the pipe as it burns back from the exposed face of the slab. The stainless steel mesh forms a lattice that helps to bind the activated intumescent within the steel collar and helps to prevent the intumescent from being consumed and falling away from the penetration prematurely.

The standard Retro-fit collar without the spring mechanism relies on the expanding intumescent to effectively close the penetration whereas the LP and HP type collars are assisted by the springs to crush and fold the intumescent into the penetration upon activation of the spring thermal link. Activation will be within the first three minutes of the test.

The exposed collars in the above reported tests remained attached to the slab, with the plug of intumescent material within the exposed collars still providing a plug and maintaining integrity of the penetration for the duration of the test.

For the pipe penetrations detailed in the above reports, the holes through the floor slab were made such that the clearance to the pipe was kept to a minimum. The gap between the pipe and the floor slab at the unexposed face was sealed with a bead of fire rated sealant.

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The significant factor therefore in initially sealing the pipe is considered to be the ability of the intumescent material to fully seal the cross sectional area of the pipe. For assessment of the performance of pipes and their non spring assisted sealing systems that have not been tested, the fill ratio between the cross sectional area of the intumescent seal prior to expansion divided by the cross sectional area of the pipe is compared with tested specimens. Where the fill ratio is greater than a tested specimen this indicates that the seal is required to expand by a lesser relative amount than the seals in the tested specimen. The spring assist collars are slightly different as the stainless steel springs force the intumescent and stainless mesh to close around the quickly softening plastic pipe material thereby ensuring that the penetration is closed quickly.

The Retro-fit collars being assessed include a variety of different pipe diameters for each collar type and as such the annular space between the pipe outer wall and the inner face of the collar varies. This has also been considered when determining the likely performance of the sealing systems for specific pipe sizes and materials.

As stated above observations of the tested specimens indicated that the plug of intumescent material and the exposed collar remained in place in all instances. The inclusion of the stainless steel mesh helps to reduce the erosion of the intumescent material and as such minimises the porosity of the seal throughout the test. The spread of data indicates that the SNAP Retro-fit collar systems, once activated, remain in situ for the desired duration without contributing to integrity failure for the element in question.

3.3 HDPE PE 80 and PE 100 Pipes

In FP 4837, FP 4640 and FSP 1146 a cross range of specimens consisted of HDPE polyethylene pipes. Specimens included a PE 80 pipe and PE 100 and HDPE Silent pipe types. The major difference between the pipe types is the density of the polyethylene with the typical density range for the pipes being as follows.

	PE80	PE100
Density kg/m^3	945-956	957-961

For the purposes of this assessment, it is considered that at the temperatures involved and the tested collar performance there is no significant difference between the pipes for a pipe penetration fire resistance perspective and as such the assessment covers polyethylene pipes of both grade PE 80 and PE 100.

3.4 Valsir Triplus Pipes

In CSIRO fire resistance tests FSP 2174 and FSP 2271 various Valsir Triplus pipes, including the smallest and largest pipe diameters of both ranges, were tested with SNAP Retro-fit fire collars.

Section 4.6 of AS 4072.1-2005 states that pipes of different diameters and wall thicknesses may be considered via assessment providing the requirements within Clause 4.6.3 and 4.6.4 have been satisfied.

Therefore, the full range of Valsir Triplus pipes have been considered within this assessment.

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3.5 Thicker or Thinner Concrete

All the test specimens reported in BRANZ fire resistance test reports FP 4428, FP 4640 and FP 4837 achieved a fire resistance level of 240 minutes in terms of the Integrity and Insulation criteria set out in AS 1530.4:2014. The specimens reported in CSIRO test report FSP 1146 achieved a fire resistance of 180 minutes in terms of the Integrity and Insulation criteria set out in AS 1530.4:2014 without failure. All the tests reported above were with the penetrations through a 150 mm thick concrete slab.

In respect to the Insulation of the test specimens in CSIRO fire resistance test FSP 1146, the test was terminated after 182 minutes. The test specimens included the LP50R collar and HDPE floorwaste configuration and showed no sign of integrity failure at the termination of the test. An increase in the thickness of the concrete would place the thermocouples on the pipe and grate further away from the furnace and is likely to reduce the temperature rise recorded on the pipe due to the decreasing temperature gradient along the pipe away from the furnace. Therefore it is expected that the insulation of the specimens will not be reduced by an increase in concrete thickness.

As the collars are mounted to the underside of the floor slab, significant heating of the side of the hole through the floor does not occur unless a hole occurs in the seal. Therefore, as no insulation failure occurred for the specimens before 240 minutes, except for the LP50R collar as discussed above and discussed separately in section 2.4, it is expected that the fire resistance of the specimen will be determined by the insulation of the concrete floor slab. As defined in Table 5.5.1 of AS 3600:2018, Concrete Structures, the required thickness of concrete to achieve a required fire resistance level (FRL) is given in Table 15.

3.6 SNAP LP50R, LP100R & HP100R Collars for Floorwaste and Stack

The most onerous pipe penetration configuration for fire resistance testing is the floor waste system, where the pipe terminates at the unexposed face with a grate located over the pipe end. The method used to close the penetration needs to be quick acting to ensure the thermocouple located on the centre of the grate does not exceed the 180K temperature rise criterion. The SNAP Retro-fit collars with spring assist have been tested in PVC-U, PVC (sandwich), HDPE PE80 and PE100 pipes for durations up to four hours without failure.

The LP50R collar was tested with a nominal 50 mm PVC-U pipe and grate in FP 4640 achieving an FRL of -/240/240. The same collar was tested in FSP 1146 with both the PE80 and HDPE Silent pipe types in a floorwaste configuration including a trap with the trap fitting located within the collar. The test was terminated after 182 minutes without failure of either specimen. The slab thickness in all test instances was 150 mm. As the collar effectively sealed the HDPE penetrations at the start of the test and as the collar has been shown to effectively plug a penetration for four hours it is considered that the LP50R collars protecting nominal 50 mm PVC-U and HDPE pipe penetrations with the fitting in the collar will achieve a fire resistance in accordance with AS 1530.4:2014, of at least Integrity 240 minutes and Insulation rating commensurate with the floor slab thickness FRL, as given in Table 15.

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The LP100R and HP100R have been tested on nominal 100 mm PVC-U and HDPE PE 80/100 pipe and grate configurations respectively for four hours without failure. As the floorwaste configurations are more onerous than the stack configuration it is considered that the collars can be used on stack pipes assemblies and will achieve a fire resistance in accordance with AS 1530.4:2014, of at least Integrity 240 minutes and Insulation rating commensurate with the floor slab thickness FRL, as given in Table 15.

Table 6: Floorwaste Retro-fit Collar Summary

Collar	Material	Pipe Diameter	With Fitting	Stack	Floorwaste & Shower
LP100R	PVC-U	100	n/a	-/240/**	-/240/240*
LP50R	PVC-U	50	-/240/**	-/240/**	-/240/240*
LP50R	HDPE	50	n/a	-/240/**	-/180/180*
LP50R	HDPE Silent	50	n/a	-/240/**	-/180/180*
HP100R	HDPE	100		-/240/**	-/240/240*

Table 6 gives the summary FRL and pipe collar configuration for floor waste assemblies.

* = Test result penetration tested in a 150 mm thick slab.

** = Assessed system, insulation rating commensurate with the floor slab thickness FRL, as given in Table 15.

Table 6: Floorwaste Retro-fit Collar Summary

Collar	Material	Pipe Diameter	With Fitting	Stack	Floorwaste & Shower
LP100R	PVC-U	100	n/a	-/240/**	-/240/240*
LP50R	PVC-U	50	-/240/**	-/240/**	-/240/240*
LP50R	HDPE	50	n/a	-/240/**	-/180/180*
LP50R	HDPE Silent	50	n/a	-/240/**	-/180/180*
HP100R	HDPE	100		-/240/**	-/240/240*

3.7 PVC-U Pipes and Sealing System

Table 7 gives the fill ratio of the SNAP Retro-fit collars for specific PVC-U pipes with their SNAP Retro-fit sealing systems.

* = fill ratio for the tested penetrations from fire resistance tests FP 4640 & FP 4837.

** = fill ratio for the assessed penetrations.

¥ = width of the annular space (mm) between the collar and the outside of the pipe.

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Table 7: PVC-U Pipes and Snap Retro-fit Collars

Nominal Size	Fill Ratio: Area of Intumescent to Pipe Cross Sectional Area									
	110R		84R		65-80R		63R		50R	
40									2.34*	7.50¥
50							1.65*	6.00¥		
65					1.34*	12.50¥	1.08**	0.00¥		
80			0.85**	1.0¥	0.95*	6.00¥				
90	1.69**	18.5¥								
100	1.13*	8.50¥								

The fill ratio for the nominal 65 mm PVC-U pipe and its 63R collar lies between two tested specimens a 65 mm and 80 mm pipe both in a 65-80R collar. There is virtually no annular space between the collar and the pipe wall. It is therefore considered that the 65 mm PVC-U pipe and SNAP 63R collar would achieve the same level of fire resistance in terms of the Integrity of the specimen as the above tested specimens. The insulation of the specimen will be commensurate with the floor slab thickness FRL, as given in Table 15.

The fill ratio for the nominal 80 mm PVC-U pipe and the 84R collar is slightly less than the nearest test equivalent being the 80 mm PVC-U and the 65-80R collar. There is virtually no annular space between the collar and the pipe wall for the 80 mm PVC-U and the 84R collar. It is therefore considered that the 65 mm PVC-U pipe and SNAP 63R collar would achieve the same level of fire resistance in terms of the Integrity of the specimen as the above tested specimens. The insulation of the specimen will be commensurate with the floor slab thickness FRL, as given in Table 15.

The fill ratio for the nominal 90 mm PVC-U pipe and its 110R collar is significantly higher than the most onerous of the tested specimens being the 100 mm PVC-U and the 110R collar. The annular space between the pipe and the collar is much greater but this is made up for by the much higher ratio of intumescent to pipe cross sectional area. It is therefore considered that the 90 mm PVC-U pipe and SNAP 110R collar would achieve the same level of fire resistance in terms of the Integrity of the specimen as the above tested specimens. The insulation of the specimen will be commensurate with the floor slab thickness FRL, as given in Table 15.

3.7.1 PVC-U Pipes with Fitting in Collar and their Sealing Systems

Table 8 gives the fill ratio of the SNAP Retro-fit collars for specific PVC-U pipes with the fitting in the collar and their SNAP Retro-fit sealing systems.

* = fill ratio for the tested penetrations from fire resistance tests FP 4640 & FP 4837.

** = fill ratio for the assessed penetrations.

¥ = width of the annular space (mm) between the collar and the outside of the pipe.

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Table 8: PVC-U Pipes with Fitting in Collar and Snap Retro-fit Collars

Nominal Size	Fill Ratio: Area of Intumescent to Pipe Cross Sectional Area							
	110R		65-80R		63R		50R	
40							1.87*	5.0¥
50					1.39*	3.5¥		
65			0.97**	6.5¥				
80			0.82**	2.9¥				
90	1.52**	16.0¥						
100	1.00*	5.0¥						

The fill ratio for the 65-80R collar and the nominal 65 mm PVC-U pipe is 0.97 as opposed to 1.0 for the most onerous of the tested specimens being the nominal 100 mm PVC-U pipe. Also, the annular space between the collar and the pipe is 1.5 mm bigger than for the larger tested specimen. It is considered that these minor differences will not prejudice the performance of the collar in terms of Integrity of the specimen with the nominal 65 mm PVC-U pipe with fitting in the collar as the overall size of the penetration is significantly less than the 100 mm pipe test. As discussed above the insulation of the specimen will be commensurate with the floor slab thickness FRL, as given in Table 15.

Similarly, the fill ratio for the 65-80R collar and the nominal 80 mm pipe is less than the most onerous tested specimens this is however offset by the reduction in the annular gap between the pipe and the inner face of the collar. It is therefore considered that the 80 mm PVC-U pipe and SNAP 65-80R collar would achieve the same level of fire resistance in terms of the Integrity of the specimen as the above tested specimens. The insulation of the specimen will be commensurate with the floor slab thickness FRL, as given in Table 15.

The fill ratio for the nominal 90 mm PVC-U pipe and its 110R collar is significantly higher than the most onerous of the tested specimens being the 100 mm PVC-U and the 110R collar. The annular space between the pipe and the collar is much greater but this is made up for by the much higher ratio of intumescent to pipe cross sectional area. It is therefore considered that the 90 mm PVC-U pipe and SNAP 110R collar would achieve the same level of fire resistance in terms of the Integrity of the specimen as the above tested specimens. The insulation of the specimen will be commensurate with the floor slab thickness FRL, as given in Table 15.

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3.7.2 PVC-U Pipe Summary

Table 9 gives the summary FRL and pipe collar configuration for PVC-U pipes.

* = Test result penetration tested in a 150 mm thick slab.

** = Assessed system, insulation rating commensurate with the floor slab thickness FRL, as given in Table 15.

Table 9: PVC-U pipe and Retro-fit Collar Summary

Collar	Material	Pipe Diameter	With Fitting	Stack	Floorwaste & Shower
110R	PVC-U	100	-/240/240*	-/240/240*	n/a
110R		90	-/240/**	-/240/**	n/a
84R		80	n/a	-/240/240**	n/a
65-80R		80	-/240/**	-/240/240*	n/a
65-80R		65	-/240/**	-/240/240*	n/a
63R		65	n/a	-/240/**	n/a
63R		50	-/240/240*	-/240/240*	n/a
50R		40	-/240/240*	-/240/240*	n/a

3.8 HDPE PE 80/100 Pipes and Sealing Systems

Table 10 gives the fill ratio of the SNAP Retro-fit collars for specific HDPE pipes and their SNAP Retro-fit sealing systems.

* = fill ratio for the tested penetrations from fire resistance tests FP 4837.

** = fill ratio for the assessed penetrations.

¥ = width of the annular space (mm) between the collar and the outside of the pipe.

Table 10: HDPE PE 80/100 Pipes and Snap Retro-fit Collars

Nominal Size	Fill Ratio: Area of Intumescent to Pipe Cross Sectional Area									
	110R		65-80R		84R		63R		50R	
40									2.70*	9.00¥
50							1.73**	9.00¥	1.73**	4.00¥
56							1.65**	6.00¥	1.38**	1.00¥
63			1.60**	15.5¥			1.30**	2.50¥		
75			1.13**	9.5¥	1.01**	4.5¥				
90	1.69**	18.5¥								
110	1.13*	8.5¥								

The fill ratio for each of the assessed collars and their respective pipe penetrations in Table 10 is consistent with or significantly greater than the most onerous of the tested systems being the SNAP 110R collar with the nominal 110 mm HDPE PE 100 pipe.

For the SNAP 84R collar and nominal 75 mm HDPE pipe the fill ratio is slightly less than the most onerous tested specimen, this is offset by the reduced annular space between the pipe and the inner face of the collar.

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The annular space between the collar and the pipe for the nominal 75 mm pipe and 65-80R collar is slightly bigger than the most onerous tested specimen. This is not considered to affect the collars ability to close the penetration effectively as the overall diameter is significantly less than the nominal 110 mm pipe and the annular space is only 1 mm bigger which is within the normal tolerance for this type of assembly.

It is therefore considered that the HDPE PE 80/100 pipes and their seals discussed above would achieve the same level of fire resistance in terms of the Integrity of the specimen as the above tested specimens. The insulation of the specimen will be commensurate with the floor slab thickness FRL, as given in Table 15.

Table 11 gives the summary FRL and pipe collar configuration for HDPE PE 80/100 pipes.

* = Test result penetration tested in a 150 mm thick slab.

** = Assessed system, insulation rating commensurate with the floor slab thickness FRL, as given in Table 15.

Table 11: HDPE PE80/100 pipe and Retro-fit Collar Summary

Collar	Material	Pipe Diameter	With Fitting	Stack	Floorwaste & Shower
110R	HDPE	100	n/a	-/240/240*	n/a
110R		90	n/a	-/240/**	n/a
65-80R		75	n/a	-/240/**	n/a
84R		75	n/a	-/240/**	n/a
65-80R		63	n/a	-/240/**	n/a
63R		63	n/a	-/240/**	n/a
50R		56	n/a	-/240/**	n/a
63R		56	n/a	-/240/**	n/a
63R		50	n/a	-/240/**	n/a
50R		50	n/a	-/240/**	n/a
50R		40	n/a	-/240/240*	n/a

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3.9 Valsir Triplus Pipes and Sealing Systems

Table 12 gives the fill ratio of the SNAP Retro-fit collars for specific Valsir Triplus pipes and their SNAP Retro-fit sealing systems.

* = fill ratio for the tested penetrations from fire resistance tests FSP 2174 and FSP 2271.

** = fill ratio for the assessed penetrations.

¥ = width of the annular space (mm) between the collar and the outside of the pipe.

Table 12: Valsir Triplus Pipes and Snap Retro-fit Collars

Nominal Size	Fill Ratio: Area of Intumescent to Pipe Cross Sectional Area					
	110R		65-80R		50R	
40					2.70*	9.00¥
50					1.73**	4.00¥
75			1.13**	9.50¥		
90	1.69**	18.50¥				
110	1.13*	8.50¥				

The fill ratio for the nominal 50 mm Valsir pipe and its 50R collar lies between two tested specimens, a 40 mm and 110 mm Valsir pipe. The annular space between the collar and the pipe wall is lower than the tested specimens. It is therefore considered that the 50 mm Valsir pipe and SNAP 50R collar would achieve the same level of fire resistance in terms of the Integrity of the specimen as the most onerous of the tested specimens. The insulation of the specimen will be commensurate with the floor slab thickness FRL, as given in Table 15.

The fill ratio for the 65-80R collar and the nominal 75 mm Valsir pipe is 1.13 which is the same as the most onerous of the tested specimens being the nominal 110 mm Valsir pipe. The annular space between the collar and the pipe for the nominal 75 mm pipe and 65-80R collar is slightly bigger than the most onerous tested specimen. This is not considered to affect the collars ability to close the penetration effectively, as the overall diameter is significantly less than the nominal 110 mm pipe and the annular space is only 1 mm bigger which is within the normal tolerance for this type of assembly.

The fill ratio for the nominal 90 mm pipe and its 110R collar is significantly higher than the most onerous of the tested specimen. The annular space between the pipe and the collar is larger but this is made up for by the much higher ratio of intumescent to pipe cross sectional area. It is therefore considered that the 90 mm pipe and SNAP 110R collar would achieve the same level of fire resistance in terms of the Integrity of the specimen as the above tested specimens. The insulation of the specimen will be commensurate with the floor slab thickness FRL, as given in Table 15.

It is therefore considered that the Valsir Triplus pipes and their seals discussed above would achieve the same level of fire resistance in terms of the Integrity of the specimen as the above tested specimens. The insulation of the specimen will be commensurate with the floor slab thickness FRL, as given in Table 15.

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Table 13 gives the summary FRL and pipe collar configuration for Valsir Triplus pipes.

* = Test result penetration tested in a 150 mm thick slab.

** = Assessed system, insulation rating commensurate with the floor slab thickness FRL, as given in Table 15.

Table 13: Valsir Triplus Pipes and Retro-fit Collar Summary

Collar	Material	Pipe Diameter	With Fitting	Stack	Floorwaste & Shower
HP 150R	Valsir Triplus	160	n/a	-/240/240*	n/a
110R		110	n/a	-/180/180*	n/a
110R		90	n/a	-/180/**	n/a
65-80R		75	n/a	-/180/**	n/a
50R		50	n/a	-/180/**	n/a
50R		40	n/a	-/240/240*	n/a

4. CONCLUSION

It is considered that the SNAP Fire Systems Retro-fit collar pipe penetration systems given in Table 14 would achieve up to the fire resistance listed in terms of the Integrity and Insulation in a floor slab with an FRL of up to 240/240/240 when tested in accordance with AS 1530.4:2014 with reference to AS 4072.1 – 2005.

For a different thickness of floor slab with a lower FRL the penetration system FRL is lowered to match the slab FRL.

Table 15 gives the required thickness of concrete to achieve a required fire resistance level (FRL).

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Table 14: Assessment Summary Table

Material	Pipe Diameter	Collar	With Fitting	Stack	Floorwaste & Shower
PVC-U	100	LP100R	n/a	-/240/240	-/240/240
	50	LP50R	-/240/240	-/240/240	-/240/240
HDPE	50	LP50R	n/a	-/240/240	-/180/180
HDPE Silent	50	LP50R	n/a	-/240/240	-/180/180
HDPE	100	HP100R	n/a	-/240/240	-/240/240
PVC-U	100	110R	-/240/240	-/240/240	n/a
	90	110R	-/240/240	-/240/240	n/a
	80	65-80R	-/240/240	-/240/240	n/a
	65	65-80R	-/240/240	-/240/240	n/a
	65	63R	n/a	-/240/240	n/a
	50	63R	-/240/240	-/240/240	n/a
	40	50R	-/240/240	-/240/240	n/a
HDPE	100	110R	n/a	-/240/240	n/a
	90	110R	n/a	-/240/240	n/a
	75	65-80R	n/a	-/240/240	n/a
	75	84R	n/a	-/240/240	n/a
	63	65-80R	n/a	-/240/240	n/a
	63	63R	n/a	-/240/240	n/a
	56	63R	n/a	-/240/240	n/a
	56	50R	n/a	-/240/240	n/a
	50	63R	n/a	-/240/240	n/a
	50	50R	n/a	-/240/240	n/a
	40	50R	n/a	-/240/240	n/a
Valsir Triplus	160	HP 150R	n/a	-/240/240	n/a
	110	110R	n/a	-/180/180	n/a
	90	110R	n/a	-/180/180	n/a
	75	65-80R	n/a	-/180/180	n/a
	50	50R	n/a	-/180/180	n/a
	40	50R	n/a	-/240/240	n/a

Table 15: Concrete Slab FRL and Slab Thickness

FRL (minutes)	Thickness (mm)
120	120
180	150
240	175

As defined in Table 5.5.1 of AS 3600:2018

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