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Fire resistance of SNAP UL100FWS fire collar when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005

Assessment Report

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Important disclaimer

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1 Introduction

This report is an assessment of fire resistance of SNAP UL100FWS fire collar when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

This report is prepared for meeting the evidence of suitability requirements of NCC 2019 (or earlier) 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 2088	AS 1530.4 -2014	A fire resistance testing of four (4) cast-in fire collars protecting a 180-mm thick concrete floor slab penetrated by a stack pipe and floor wastes
FSP 2111	AS 1530.4 -2014	A fire resistance testing of two (2) cast-in fire collars protecting a 180-mm thick concrete floor slab penetrated by stack pipes and a floor waste

The reports FSP 2088 and FSP 2111 were undertaken by CSIRO North Ryde and sponsored by IG6 Pty Ltd as trustee for the IG6 IP Trust.

3 Proposed Variations

The proposed construction shall be for service penetrations tested in FSP 2088 and FSP 2111 subject to the following variations:

- The central pipe may be installed as either a Floor-waste or Stack configuration as shown in Figure 1 and figure 2 respectively.
- Where a stack pipe is connected to the 4-way riser, it may emerge from the slab at 255mm or greater from the central riser pipe as shown in Figure 1.
- Where a floor waste pipe is connected to the 4-way riser, it may emerge from the slab at 240mm or greater from the central riser pipe, with the floor waste pipe to be finished with a minimum 15-mm thick grout screed as shown in Figure 1.
- The 4-way riser may be connected to any combination floor wastes and stack pipes up to a total of 4 as shown in Figure 1.
- The floor slab may be 180mm or thicker.

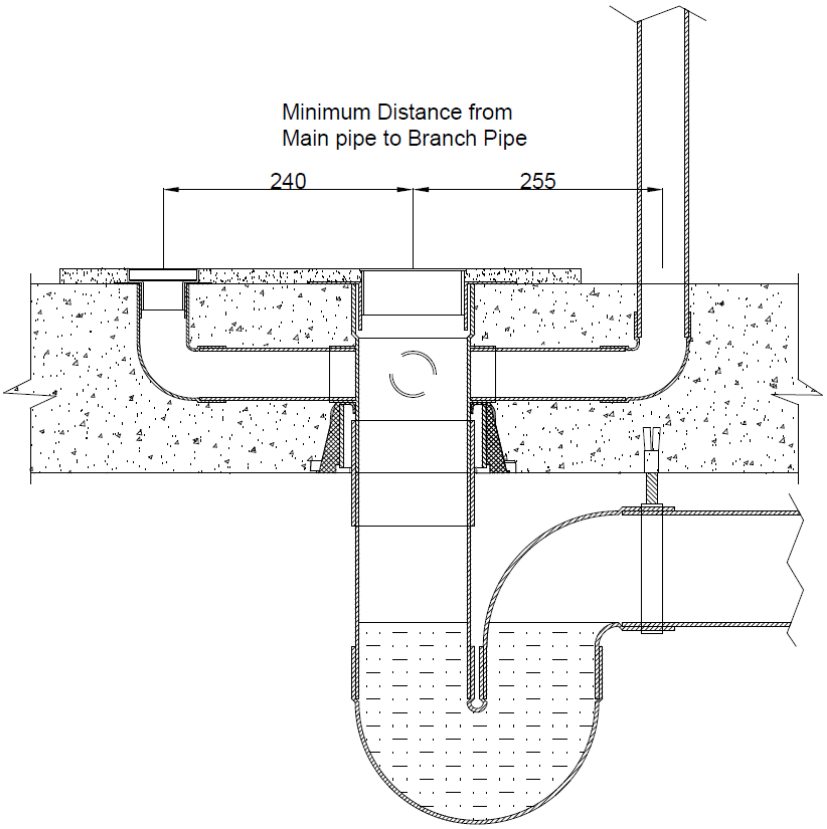

Figure 1: Central pipe in floor waste configuration, four way riser connected to branch floor waste or riser pipes

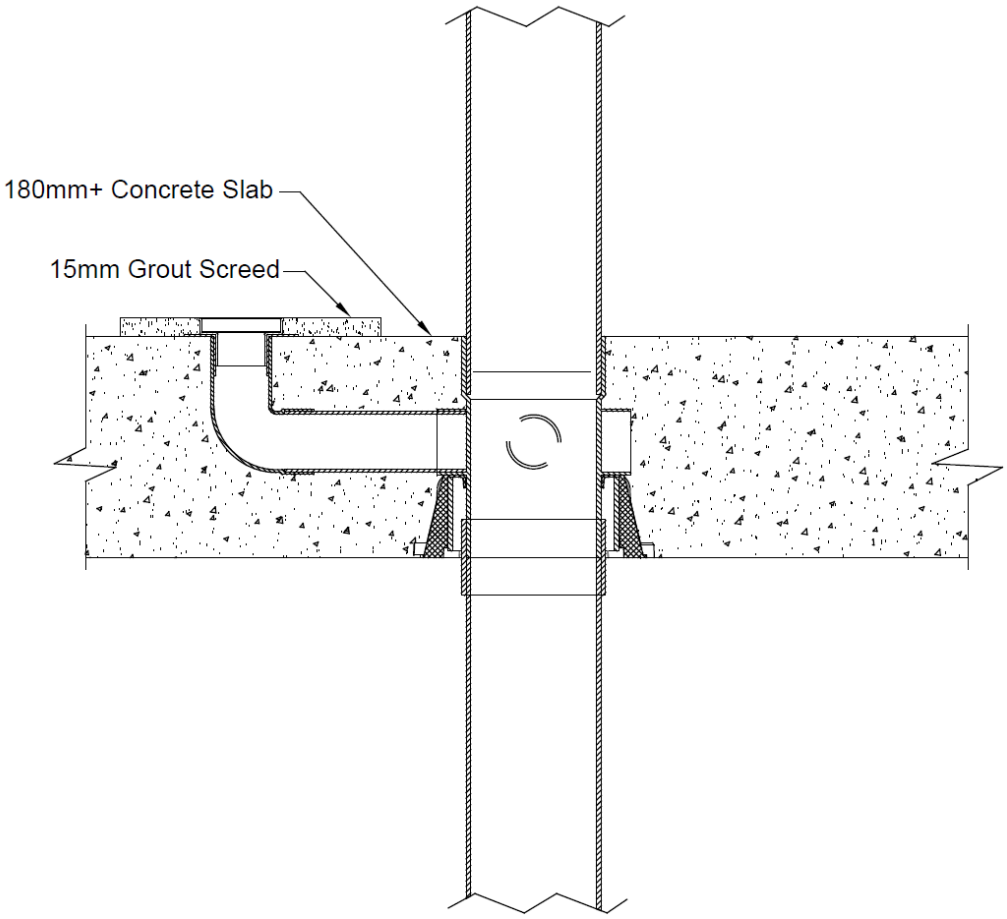

Figure 2: Central pipe in stake configuration

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 2 – Pipe penetration details

Support Construction	Pipe Material	Connection/pipes	Snap Fire Collar	Main pipe configuration	Branch pipes	FRL
Minimum 180mm thick concrete floor slab with an FRL of at least 240/240/240	PVC-SC	4-way riser connected to a maximum of 4 branch pipes	UL100FWS collar	100mm stack pipe	40mm or 50mm stake pipe or floor waste pipe	-/240/240
				100mm floor waste pipe		-/240/180

6 Direct Field of Application of Results

The results of this report are applicable to floors exposed to fire from below

7 Requirements

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

Any variations 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 2088

On 27 February 2020, CSIRO North Ryde conducted a fire-resistance test on four (4) cast-in fire collars protecting a 180-mm thick concrete floor slab penetrated by a stack pipe and floor wastes.

The penetrated slab comprised a 180-mm thick concrete slab reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 240 minutes in accordance with table 5.5.1 of AS 3600:2018 - Concrete structures.

The pipes used in the test are stated to be manufactured in accordance with:

• AS/NZS 1260 PVC-U pipes and fittings for drain, waste and vent application.

In this test report, the specimens were referenced as Specimens 1, 2, 3, and 4. Only two (2) specimens are the subject of this report (Specimens 2 and 3). Documents containing a complete description of each specimen were supplied by the sponsor and are retained on file.

Specimen 2 – SNAP UL100FWS Cast-in fire collar protecting a nominal 100-mm PVC 4-way riser cast in the slab incorporating a nominal 100-mm PVC-SC stack pipe, a nominal 50-mm PVC sidearm with a floor waste and a PVC coupling fitted inside the collar

The SNAP UL100FWS Cast-in fire collar comprised a moulded plastic casting with a 110 mm inner diameter and a 194-mm x 196-mm base flange. The 67-mm high collar casing incorporated 4-mm thick x 60-mm wide x 426-mm long Intumesh intumescent strip. The closing mechanism comprised four 4-mm diameter (SPR-SS400-60-Z) stainless steel springs, a nylon fuse link and a 455-mm x 58 mm stainless steel mesh as shown in drawing numbered UL100FWS dated 31 January 2020, by SNAP Fire Systems.

The penetrating service comprised a PVC 4-way riser fitted through the collar's sleeve within the slab incorporating a PVC-SC stack pipe, a PVC sidearm with a waste trap and a PVC coupling fitted through the fire collar's sleeve joining a second PVC-SC pipe. The PVC-SC stack pipe had a 110-mm outside diameter with a wall thickness of 3.62-mm and projected vertically 2000-mm above the slab on the unexposed face and was supported at 500-mm and 1500-mm. From the side of the 4-way riser within the slab, a 56.3-mm outside diameter pipe with a wall thickness of 2.6-mm incorporated a nominal 50-mm PVC floor waste that penetrated the unexposed face. The floor waste system was fitted with a chrome brass grate and a PVC Puddle Flange. A 15-mm thick grout screed was laid on top of the concrete slab and finished flush with the floor grate. On the exposed side of the concrete slab, the lower section of 110-mm PVC-SC pipe was connected to the 4-way riser with a PVC coupling fitted inside the collar's sleeve. The 110-mm PVC-SC pipe projected vertically 500-mm down into the furnace chamber and was capped with a 110-mm PVC end cap.

Specimen 3 – SNAP UL100FWS Cast-in fire collar protecting a nominal 100-mm PVC 4-way riser cast in the slab incorporating a 100-mm floor waste, a nominal 50-mm PVC sidearm with a 50-mm floor waste, a P-trap and a PVC coupling fitted inside the collar

The SNAP UL100FWS Cast-in fire collar comprised a moulded plastic casting with a 110 mm inner diameter and a 194-mm x 196-mm base flange. The 67-mm high collar casing incorporated 4-mm thick x 60-mm wide x 426-mm long Intumesh intumescent strip. The closing mechanism comprised four 4-mm diameter (SPR-SS400-60-Z) stainless steel springs, a nylon fuse link and a 455-mm x 58 mm stainless steel mesh as shown in drawing numbered UL100FWS dated 31 January 2020, by SNAP Fire Systems.

The penetrating service comprised a PVC 4-way riser fitted through the collars sleeve within the slab incorporating a 100-mm PVC floor waste, a PVC sidearm with a second 50-mm floor waste, a PVC coupling and a p-trap. Both the 100-mm floor waste directly above the 4-way riser and the second 50-mm PVC floor waste attached through a 56.3-mm outside diameter side arm pipe with a 2.5-mm thick

wall was fitted with a chrome brass grate and a PVC puddle flange. A 15-mm thick grout screed was laid on top of the concrete slab and finished flush with the floor grates. On the exposed side of the concrete slab, a PVC P-trap was connected to the 4-way riser with the PVC coupling fitted inside the collar's sleeve, the P-trap was supported by a single M10 threaded rod and steel and drop-in anchor fixed to the concrete slab and a 110-mm nut clip to the P-trap and capped with PVC end cap. The floor waste gully was charged with water in the p-trap bend.

Specimen 2 maintained integrity and insulation for 241 minutes duration of the test. Specimen 3 maintained integrity for 241 minutes duration of the test and failed insulation at 183 minutes on the centre of the metal grate of Specimen 3 floor waste.

A.2. Test report FSP 2111

On 25 May 2020, CSIRO North Ryde conducted a fire-resistance test on a specimen comprised an 1150-mm x 1150-mm x 180-mm thick concrete slab with 300-mm x 300-mm square section recessed to a thickness of 120-mm. The slab was penetrated by multiple services protected by two (2) cast-in fire collars.

The penetrated section of the slab in Specimen 1 comprised a 180-mm thick concrete slab reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 240 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures.

The penetrated section of the slab in Specimen 2 comprised a 300-mm x 300-mm square recess section with a 100-mm thick concrete topped with a 20-mm thick layer of grout providing a Fire Resistance Period (FRP) for insulation of 120 minutes in accordance with Table 5.5.1 of AS 3600:2018 - Concrete structures.

The pipes used in the test are stated to be manufactured in accordance with:

• AS/NZS 1260 PVC-U pipes and fittings for drain, waste and vent application.

In this test report the test, the specimens were referenced as Specimens 1 and 2.

Specimen 1 – SNAP UL100FWS Cast-in fire collar protecting a 100-mm PVC 4-way riser incorporating a nominal 100-mm PVC-SC stack pipe, two nominal 50-mm PVC stack pipes, two nominal 40-mm PVC stack pipes and a PVC coupling fitted inside the collar

The SNAP UL100FWS Cast-in fire collar comprised a moulded plastic casting with a 110 mm inner diameter and a 194-mm x 194-mm base flange. The 67-mm high collar casing incorporated 4-mm thick x 60-mm wide x 426-mm long Intumesh intumescent strip. The closing mechanism comprised four 4-mm diameter (SPR-SS400-60-Z) stainless steel springs, a nylon fuse link and a 455-mm x 58 mm stainless steel mesh as shown in drawing numbered UL100FWS dated 25 May 2020, by SNAP Fire Systems.

The penetrating service comprised a PVC 4-way riser fitted through the collars sleeve within the slab incorporating; a 100-mm PVC-SC stack pipe, two 50-mm PVC stack pipes and two 40-mm stack pipes, a PVC coupling fitted inside the fire collars' sleeve joining a second PVC-SC pipe.

The Iplex polyvinyl chloride sandwich construction stack pipe had a 110-mm outside diameter with a wall thickness of 3.47-mm and projected vertically 2000-mm above the slab on the unexposed face. Two Pipemakers 50-mm stack pipes were attached to the 4-way riser via two side arms using a 90-degree PVC elbow section that extended 170-mm horizontally through the concrete slab before projecting up vertically 2000-mm above the unexposed face. The nominal 50-mm PVC pipe had an outside diameter of 56-mm and a wall thickness of 2.2-mm. Two Iplex 40-mm stack pipes were attached to the 4-way riser via two of the side arms using a 90-degree elbow section that extended 160-mm horizontally through the concrete slab before projecting up vertically 2000-mm above the unexposed face. The nominal 40-mm PVC pipe had an outside diameter of 42.7-mm and a wall thickness of 2.12 mm. All five stack pipes were supported above the unexposed face at 500 mm and 1500 mm and their ends were left open.

A 110–mm PVC-SC pipe was connected to the base of the 4-way riser via a PVC coupling which was fitted inside the collar's sleeve. The pipe projected vertically 500 mm down into the furnace chamber and was capped with a 110-mm PVC end cap.

Specimen 2 – SNAP UL100FWS Cast-in fire collar protecting a nominal 100-mm polyvinyl chloride sandwich construction (PVC-SC) floor waste incorporating a PVC 4-way riser fitted below the collar

The SNAP UL100FWS Cast-in fire collar comprised a moulded plastic casting with a 110 mm inner diameter and a 194-mm x 194-mm base flange. The 67-mm high collar casing incorporated 4-mm thick x 60-mm wide x 426-mm long Intumesh intumescent strip. The closing mechanism comprised four 4-mm diameter (SPR-SS400-60-Z) stainless steel springs, a nylon fuse link and a 455-mm x 58 mm stainless steel mesh as shown in drawing numbered UL100FWS dated 25 May 2020, by SNAP Fire Systems.

The penetrating service comprised a nominal 100-mm Iplex floor waste system. The floor waste pipe had a 110-mm outside diameter polyvinyl chloride sandwich construction pipe with a wall thickness of 3.4-mm fitted through the collar's sleeve.

The floor waste system was fitted with a chrome brass grate. A 20-mm thick grout screed was laid on top of the 100-mm thick concrete slab and finished flush with the floor grate. On the exposed side of the slab, a 4-way riser was connected below the fire collar to the penetrating pipe and supported by two M5 30-mm concrete screw bolts and a steel strap. The 4-way riser was capped using a polyvinyl chloride end cap. The floor waste gully was charged with water to just above the 4-way riser.

Specimen 1 maintained integrity and insulation for 241 minutes duration of the test. Specimen 2 maintained integrity for 241 minutes duration of the test and failed insulation at 184 minutes on the centre of the metal grate of Specimen 2 floor waste.

Appendix B Analysis of Variations

B.1 Variations to tested construction

The proposed construction shall be for service penetrations tested in FSP 2088 and FSP 2111 subject to the following variations:

- The central pipe may be installed as either a Floor-waste or Stack configuration as shown in Figure 1 and figure 2 respectively.
- Where a stack pipe is connected to the 4-way riser, it may emerge from the slab at 255mm or greater from the central riser pipe as shown in Figure 1.
- Where a floor waste pipe is connected to the 4-way riser, it may emerge from the slab at 240mm or greater from the central riser pipe, with the floor waste pipe to be finished with a minimum 15-mm thick grout screed as shown in Figure 1.
- The 4-way riser may be connected to any combination floor wastes and stack pipes up to a total of 4 as shown in Figure 1.
- The floor slab may be 180mm or thicker.

Branch stack pipes with central stack pipe

With reference to FSP 2111 specimen 1, it comprised a PVC 4-way riser fitted through the collars sleeve within the slab incorporating; a 100-mm PVC-SC stack pipe, two 50-mm PVC stack pipes and two 40-mm stack pipes, a PVC coupling fitted inside the fire collars' sleeve joining a second PVC-SC pipe.

An Iplex polyvinyl chloride sandwich core construction (PVC-SC) stack pipe that had a 110-mm outside diameter with a wall thickness of 3.47-mm and projected vertically 2000-mm above the slab on the unexposed face. Two Pipemakers 50-mm stack pipes were attached to the 4-way riser via two side arms using a 90-degree PVC elbow section that extended 170-mm horizontally through the concrete slab before projecting up vertically 2000-mm above the unexposed face. The nominal 50-mm PVC pipe had an outside diameter of 56-mm and a wall thickness of 2.2-mm. Two Iplex 40-mm stack pipes were attached to the 4-way riser via two of the side arms using a 90-degree elbow section that extended 160-mm horizontally through the concrete slab before projecting up vertically 2000-mm above the unexposed face. The nominal 40-mm PVC pipe had an outside diameter of 42.7-mm and a wall thickness of 2.12 mm. All five stack pipes were supported above the unexposed face at 500 mm and 1500 mm and their ends were left open.

A 110–mm PVC-SC pipe was connected to the base of the 4-way riser via a PVC coupling which was fitted inside the collar's sleeve. The pipe projected vertically 500 mm down into the furnace chamber and was capped with a 110-mm PVC end cap. Specimen 1 maintained integrity and insulation for 241 minutes duration of the test.

The significance of this specimen performance is that it shows the two 50mm and the two 40mm stack pipes when branched from above the collar were able to maintain integrity and insulation when emerges from the slab at a minimum distance of 160mm from the main central stack pipe, which is a minimum of 230mm from centre of central pipe to centre of branch pipe. All these smaller stack pipes were able to maintain a temperature of less than 100°C at 25mm from the slab for up to 240 minutes.

The proposed variation requires these pipes to be at a greater distance from the main central stack pipe, which will allow the hot air in the pipe to travel through a greater distance of concrete that will absorb heat away from the pipe, resulting in a cooler stack pipe where it emerges above the slab than that measured in FSP 2111 specimen 1.

Branch floor waste pipes with central stack pipe

With reference to FSP 2088 specimen 2, it comprised a PVC 4-way riser fitted through the collar's sleeve within the slab incorporating a PVC-SC stack pipe, a PVC sidearm with a waste trap and a PVC coupling fitted through the fire collar's sleeve joining a second PVC-SC pipe. The PVC-SC stack pipe had

a 110-mm outside diameter with a wall thickness of 3.62-mm and projected vertically 2000-mm above the slab on the unexposed face and was supported at 500-mm and 1500-mm. From the side of the 4-way riser within the slab, a 56.3-mm outside diameter pipe with a wall thickness of 2.6-mm incorporated a nominal 50-mm PVC floor waste that emerged from the unexposed face at a 240mm distance from the stack pipe. The floor waste system was fitted with a chrome brass grate and a PVC Puddle Flange. A 15-mm thick grout screed was laid on top of the concrete slab and finished flush with the floor grate. On the exposed side of the concrete slab, the lower section of the 110-mm PVC-SC pipe was connected to the 4-way riser with a PVC coupling fitted inside the collar's sleeve. The 110-mm PVC-SC pipe projected vertically 500-mm down into the furnace chamber and was capped with a 110-mm PVC end cap. Specimen 2 maintained integrity and insulation for 241 minutes duration of the test.

The significance of this specimen performance is that it shows the floor waste pipes were able to maintain integrity and insulation when emerges from the slab at a minimum distance of 240mm from the main riser pipe.

Combination of pipe with riser with central stack or floor waste pipe

The proposed construction comprises the central stack or floor waste pipe to have any combination of branch floor waste and stack pipes up to a total of 4.

A comparison between specimen 1 and 2 in FSP 2111 and Specimen 2 and 3 in FSP 2088 shows that when the 4-way riser contains a main 100mm central stack pipe, the smaller stack pipe or the floor waste pipe and its metal grate were able to maintain insulation for up to 240 minutes. However, when the centre pipe is a 100mm floor waste pipe, the connected floor waste pipe, and its metal grate is only able to maintain insulation for 180 minutes before the metal grate fails insulation.

This is due to the stack effect produced within a 2m long non-fire side extension of the riser pipe. This has the effect of drawing hot gases through the pipe away from the 4-way riser while the 100mm floor waste pipe does not behave is such a manner and therefore there is less tendency for hot gases to be directed to the branching pipes.

This observation and the fundamental aspect of the behaviour observed provides sufficient confidence that any of proposed configurations of floor wastes and stack pipes up when joined to a 100mm central stack pipe, will be able to maintain integrity and insulation for 240 minutes.

On the same note, any of proposed configurations of floor wastes and stack pipes up when joined to a 100mm central floor waste pipe, will be able to maintain integrity and insulation for 180 minutes.

Based on the above, it is considered the proposed variations will maintain integrity and insulation for up to 240 minutes when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1 -2005.

Increase in floor thickness

The proposed construction comprises the increase of slab thickness from the 180mm thick slab tested in FSP 2088 and FSP 2011. The increase of slab thickness will increase the heat sink effect offered by the slab and increase the distance the hot gases must travel in the slab. This factors when combined mean the unexposed side of the specimen and the slab will achieve an improved insulation performance compared to that of the referenced tests.

Further confidence in the ability of concrete floors to perform for the required FRL is offered by reference to AS 3600-2018 clause 5.5, where the required floor thicknesses by that standard are the same as those proposed for the given FRL.

Based on the above, it is expected that the proposed variations will be able to maintain integrity and insulation for up to 240 minutes when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1 -2005.

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