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Fire resistance of various SNAP fire collars with Geberit pipes when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005

Assessment Report

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Contents

1 Introduction

This report is an assessment of fire resistance of various SNAP fire collar with Geberit pipes 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 requirements of NCC 2019 Amdt.1 Schedule 5 clause 2(b) and 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
FP 4640	AS 1530.4 - 2005	A fire resistance testing of eight pipe penetrations in a 150 mm thick reinforced concrete slab representing a structural concrete floor.
FP 4837	AS 1530.4 - 2005	A fire resistance testing of nine pipe penetrations in a 150 mm thick reinforced concrete slab representing a structural concrete floor.
FSP 1577	AS 1530.4 - 2005	A fire resistance testing of an 1150-mm x 1150-mm x 150 mm thick reinforced concrete slab penetrated by four floor waste systems and one stack pipe protected by cast-in Snap Fire System fire collars.
FSP 1592	AS 1530.4 - 2005	A fire resistance testing of a 150 mm thick reinforced concrete slab penetrated by four floor waste systems and one stack pipe protected by cast-in Snap Fire System fire collars.
FSP 1883	AS 1530.4 - 2014	A fire resistance testing of an 1150-mm x 1150-mm x 120-mm thick concrete slab consisting of nominal 1000-mm x 800-mm x 120-mm thick section of Bondek floor slab and the remainder a 150-mm thick concrete slab penetrated by four (4) stack pipes and one (1) floor waste protected by a cast in fire collars.
FSP 1904	AS 1530.4 - 2014	A fire resistance testing of an 1150-mm x 1150-mm x 150-mm thick reinforced concrete slab penetrated by a total of two (2) stack pipes.
FSP 2028	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 protected by five Snap Fire Systems Cast-in fire collars. 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.
FSP 2050	AS 1530.4 - 2014	A fire resistance testing of five (5) cast-in fire collars protecting a 150-mm thick concrete floor slab penetrated by five (5) stack pipes.
FSP 2116	AS 1530.4 - 2014	A fire resistance testing of an 1150-mm x 1150-mm reinforced concrete slab penetrated by Unplasticized polyvinyl chloride (PVC-U) and high density polyethylene (HDPE) pipes protected by cast-in and retrofit Snap Fire Systems fire collars n 1150-mm x 1150-mm x 150-mm thick concrete slab penetrated by five (5) stack pipes protected by five Snap Fire Systems Cast-in fire collars.
P112838-1005	EN 1366 Part 3:2009	A fire resistance testing of six (6)cast-in Suresnap fire collars protecting a 150-mm thick concrete floor slab penetrated by six (6) stack pipes.

The reports FP 4640 and FP 4837 were undertaken by Branz NZ and sponsored by Snap Fire Systems Pty. Ltd. who has given CSIRO permission to use these reports for assessment purposes. A comparison and statement about the equivalence of these reports to one conducted in accordance with AS 1530.4-2014 is included in Appendix A of this report.

The reports FSP 1577, FSP 1592 were undertaken by CSIRO North Ryde and sponsored Snap Fire Systems Pty. Ltd. who has given CSIRO permission to use these reports for assessment purposes. A comparison and statement about the equivalence of these reports to one conducted in accordance with AS 1530.4-2014 is included in Appendix A of this report.

The reports FSP 1883, FSP 1904, FSP 2028, FSP2050 and FSP 2072 were undertaken by CSIRO North Ryde and sponsored by IG6 Pty Ltd.

The reports P112838-1005 was undertaken by BRE and sponsored by Snap Fire Systems has confirmed CSIRO can use the above reports for this assessment. A comparison and statement about the equivalence of this report to one conducted in accordance with AS 1530.4-2014 is included in Appendix A of this report.

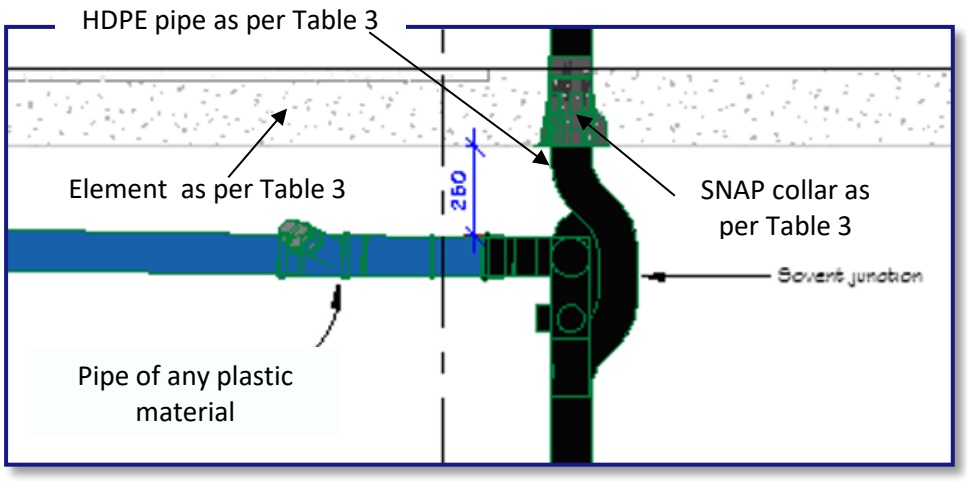
3 Proposed Variations

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

- The L100FWS tested in FSP 1592 specimen 4 shall be applied to stack applications
- The HP100R tested in FP 4640 specimen 2 shall be applied to stack applications
- The 110mm HDPE pipes tested will be replaced with a Geberit Sovent and that the pipe(s) emerging horizontally from the Geberit Sovent as shown in Figure 1 can be of any plastic material.
- The 110mm HDPE pipes tested will be replaced with a Geberit Supertube BottomTurn where the fitting is installed as high into the collar as practical
- The Geberit Sovent and Geberit Supertube BottomTurn may be butt welded to the Geberit Supertube piping with a nominally 3mm weld where the weld is formed by a hot plate between two pipe sections, then removed letting the pipes fuse.
- The butt joint and sleeve/coupling for Sovent or Supertube may be anywhere in the collar.
- The separating element shall be 120mm Bondek for -/240/120 applications.
- The separating element shall be 150mm concrete for -/240/180 applications.
- The separating element shall be 170mm concrete for -/240/240 applications.
- The 1mm annular gap between the pipe and floor substate be sealed with Fuller Firesound sealant to 10mm depth.
- Annular gap between the pipe and the inside collar casing to be sealed with a 10mm bead Fuller Firesound sealant.

Table 2: Snap collars in various elements

Element	SNAP Collar Code
120mm Bondek	HP100R 110R H100S-RR L100FWS H150S-RR H110S
150mm concrete	
170mm concrete	



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 3 – SNAP collars with Geberit piping system

Separating Element	SNAP Collar Code	110mm Diameter Pipe Type	Pipe Configuration	FRL
Concrete slab 120mm thick or more with Bondek	HP100R 110R H100S-RR L100FWS H110S	Geberit piping system	Stack	-/240/120
Concrete slab 150mm thick or more with	HP100R 110R H100S-RR L100FWS H110S			-/240/180
Concrete slab 170mm thick or more with	HP100R 110R H100S-RR L100FWS H110S			-/240/240
Concrete slab 120mm thick or more with Bondek	H150S-RR			-/180/120
Concrete slab 150mm thick or more with				-/180/180

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 FP 4640

On 18 October 2011, BRANZ Ltd NZ, conducted a fire-resistance test on eight pipe penetrations in a 150 mm thick reinforced concrete slab representing a structural concrete floor. All the pipes consisted of either PVC-U DWV or HDPE DWV plastic pipe.

Penetration 2 – HP 100 R fire collar protecting a 110-mm Geberit 110 x 4.3 SDR 26 PE 100 pipe

The HP 100 R fire collar was retrofitted to the underside of the concrete slab and held in place with 3 brackets fixed to the slab using 6.5mm diameter x 35mm length sleeve anchor.

The penetrating service comprised a 110 mm Geberit 110 x 4.3 SDR 26 PE 100 pipe, with a wall thickness of 4.87-mm. The floor waste system was capped on the unexposed face with ABS grate which is flash with the concrete and sealed with a bead of Sika Fire Sealant. On the exposed side of the slab, a 110-mm OD HDPE gully trap was connected to the penetrating pipe using electric weld and was supported by a 100mm Nut clip fixed to the concrete slab with M10 HKD. On the exposed face, the floor waste gully was sealed using an HDPE end cap.

The specimen maintained integrity and insulation without failure for 245 minutes duration of the test.

A.2. Test report FP 4837

On 24 May 2012, BRANZ Ltd NZ conducted a fire-resistance test on nine pipe penetrations in a 150 mm thick reinforced concrete slab representing a structural concrete floor. All the pipes consisted of either PVC-U DWV or HDPE DWV plastic pipe.

Penetration 1 – 110 R fire collar protecting a 110-mm Vinidex Recyclable PE 100 110 x 4.3 SDR26 pipe

The SNAP 110 R retro-fit collar body was fabricated from 0.95 mm thick galvanised steel. The retro-fit collar was secured to the slab with three equally spaced brackets around the perimeter of the collar body with M6.5 x 35 mm sleeve anchors. The brackets were fabricated from 2 mm thick galvanised steel and consisted of a 20 mm wide angle bracket with leg lengths measuring 33 mm and 30 mm. The sleeve anchor passed through an 8 mm Ø hole through the longer leg length, the bracket was screw fixed to the body of the collar with a self-tapping screw.

The penetrating service comprised a 110 mm Vinidex Recyclable PE 100 110 x 4.3 SDR26 pipe, with a wall thickness of 4.7-mm. The pipe protruded a minimum of 500 mm into the furnace and at least 2,000 mm to the unexposed face and were capped on the exposed ends using a Kaowool plug and were open on the unexposed end. The penetration through the slab had a maximum of 1-2 mm clearance between the pipe and the penetration. Bostik Firecaulk fire rated acrylic sealant was applied around the pipe and the floor slab on the unexposed face of specimens 1.

The specimen maintained integrity and insulation without failure for 245 minutes duration of the test

A.3. Test report FSP 1577

On 18 February 2013, CSIRO North Ryde conducted a fire-resistance test on an 1150-mm x 1150-mm x 150 mm thick reinforced concrete slab penetrated by four floor waste systems and one stack pipe protected by cast-in Snap Fire System fire collars.

Penetration 1 – H100 S cast-in fire collar protecting a 100-mm High Density Polyethylene (HDPE) pipe

The SNAP Cast-in H100 S fire collar comprised a 1.6-mm thick HDPE casing with a 127-mm inner diameter and a 182-mm diameter base flange. The 107-mm high collar casing incorporated a 412-mm x 85-mm x 4-mm thick intumescent material. The closing mechanism comprised three galvanized steel springs, a nylon fuse link and a 460-mm x 85-mm stainless steel mesh.

The penetrating service comprised a 110-mm OD HDPE pipe, with a wall thickness of 5-mm fitted through the collar sleeve. The pipe projected vertically, 2000-mm above the concrete slab and 500 mm into the furnace chamber. The pipe was supported at 1000 mm from the unexposed face of the concrete slab. The pipe was open at the unexposed end and capped on the exposed end using a Kaowool plug.

On the unexposed face, the narrow gap between the pipe and the slab was filled with Fuller Firesound sealant to a 10-mm depth.

The specimen maintained integrity and insulation without failure for 241 minutes duration of the test.

A.4. Test report FSP 1592

On 29 May 2013, CSIRO North Ryde conducted a fire-resistance test on an 1150-mm x 1150-mm x 150 mm thick reinforced concrete slab penetrated by four floor waste systems and one stack pipe protected by cast-in Snap Fire System fire collars.

Penetration 4 – L 100 FWS cast-in fire collar protecting a 110-mm diameter High Density Polyethylene (HDPE) pipe incorporating a floor waste

The SNAP Cast-in L 100 FWS fire collar comprised a 1.6-mm thick HDPE casing with a 110-mm inner diameter and a 182-mm diameter base flange. The 115-mm high collar casing incorporated a 412-mm x 85-mm x 4-mm thick intumescent material. The closing mechanism comprised three stainless steel springs, a nylon fuse link and a 460-mm x 85-mm stainless steel mesh.

The penetrating service comprised a 110-mm OD HDPE pipe, with a wall thickness of 4.7 mm fitted through the L 100 FWS Snap fire collar. The floor waste system was capped on the unexposed face with chromed brass floor waste grate, a 35-mm thick cement screed was laid on top of the concrete slab and finished flush with the floor grate. On the exposed side of the slab, a 110-mm OD HDPE gully trap was connected to the penetrating pipe, supported by a Saddle Clamp fixed to the concrete slab with 6.5/M5-35mm Dynabolts. On the exposed face, the floor waste gully was sealed using an HDPE end cap. The floor waste gully was charged with water.

The specimen maintained integrity and insulation without failure for 241 minutes duration of the test.

A.5. The relevance of test data in accordance with AS 1530.4 -2005 to AS 1530.4 - 2014

The referenced fire resistance test FP 4640, FP 4837, FSP 1577 and FSP 1592 were conducted in accordance with AS 1530.4– 2005, which differs slightly from AS 1530.4–2014. These variations and their potential effect on the fire resistance performance of the referenced test specimen are discussed below.

Temperature Regime

The furnace heating regime in fire resistance tests conducted in accordance with AS 1530.4- 2014 follows a similar trend to that in AS 1530.4-2005. The specified specimen heating rate in AS 1530.4-2005 is given by:

$$T_t - T_0 = 345_{log}(8t+1) + 20$$

Where;

T_t = Furnace temperature at time t, in degrees Celsius.

T_o = Initial furnace temperature, in degrees Celsius, such that.

t = Time into the test, measured from the ignition of the furnace, in minutes.

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4– 2005 and AS 1530.4–2014 are not appreciably different.

Furnace Pressure

The furnace pressure conditions for single and multiple penetrations sealing systems in AS 1530.4-2005 and AS 1530.4-2014 are not appreciably different. The parameters outlining the accuracy of control of the furnace pressure in AS 1530.4-2014 and AS 1530.4-2005 are not appreciably different.

Performance Criteria

AS 1530.4-2014 specifies the following performance criteria for building materials and structures:

• Structural Adequacy – (Not relevant to the referenced test)

• Integrity

• Insulation

Integrity

The failure criteria for integrity in AS 1530.4-2014 and AS 1530.4-2005 are not appreciably different.

Insulation

The positions of thermocouples and failure criteria for insulation in AS 1530.4-2014 and AS 1530.4-2005 are not appreciably different.

Application of Test Data to AS 1530.4-2014

Based on the above discussion, the test identified above is confirmed by this Accredited Testing Laboratory to be equivalent or more severe than a Standard Fire Test in accordance with the test standard specified in Section 4 of this report when applied to the specimen identified above.

Based on the above discussion it is considered that the results of the referenced tests would not have been appreciably different if they were undertaken in accordance with AS 1530.4-2014.

A.6. Test report FSP 1883

On 22 February 2018, CSIRO North Ryde conducted a fire-resistance test on an 1150-mm x 1150-mm x 120-mm thick concrete slab consisting of nominal 1000-mm x 800-mm x 120-mm thick section of Bondek floor slab and the remainder a 150-mm thick concrete slab penetrated by four (4) stack pipes and one (1) floor waste protected by a cast in fire collars.

Penetration 2 – H100S-RR cast-in fire collar protecting a nominal 110-mm polyethylene (PE100) stack pipe

The SNAP H100S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5-mm inner diameter and a 213-mm base flange. The 250-mm high collar casing incorporated a layer of 412 mm x 85 mm x 4-mm thick Intumescent material. The closing mechanism comprised 3 x galvanised steel springs bound with a natural nylon fuse links and 316 stainless steel mesh measuring 460 x 83-mm as shown in drawing numbered H100S-RR dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 110-mm diameter PE100 pipe with a total wall thickness of 5 mm fitted through the collar sleeve. A 177-mm diameter opening was cut into the Bondek sheet with a hole saw and the collar fixed centrally over the hole. The pipe projected vertically 2000-mm above the concrete and 500 mm into the furnace chamber and was supported at 500-mm and 1500 mm from the unexposed face of the slab. The pipe was open at the unexposed end and capped on the exposed end with ceramic fibre. On the unexposed side of the slab, there was a 10-mm deep bead of Fullers Firesound around the base of the pipe.

The specimen maintained integrity for 241 minutes duration of the test and failed insulation at 164 minutes.

A.7. Test report FSP 1904

On 23 April 2018, CSIRO North Ryde conducted a fire-resistance test on an 1150-mm x 1150-mm x 150-mm thick reinforced concrete slab penetrated by a total of two (2) stack pipes. All service penetrations were protected by fire collars.

The H150R-SS collar comprised a plastic casing with a 182-mm inner diameter and a 283-mm external diameter base flange. The 250-mm high collar casing incorporated a layer of 600-mm x 110-mm x 6-mm thick intumescent material, as shown in drawing titled H150S-RR-T provided by SNAP Pty Ltd. The Snap collar was cast face down on the exposed face of the slab.

A 110-mm OD, Valsir 110 HDPE SDR26 pipe with a wall thickness of 4.2-mm extended 2000-mm from the unexposed side and 500-mm from the exposed face. It was sealed on the exposed end with an HDPE Cap plug and left open on the unexposed end.

The specimen maintained integrity and insulation without failure for 186 minutes duration of the test.

A.8. Test report FSP 2028

On 30 July 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 protected by five Snap Fire Systems Cast-in fire collars. 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.

Specimen 4 – SNAP H100S-RR Cast-in collar protecting a nominal 110-mm HDPE (PE100) stack pipe.

The SNAP Cast-in H100S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5 mm inner diameter and a 213-mm diameter base flange. The 250 mm high collar casing incorporated a 412-mm x 85-mm x 4-mm thick Intumesh intumescent material and a rubber ring seal. The closing

mechanism comprised three equally spaced 3.15-mm diameter galvanised steel springs bound with nylon fuse links acting against a 460-mm x 83-mm 316 stainless steel mesh as shown in drawing numbered H100S RR-T dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 110-mm outside diameter HDPE pipe with a wall thickness of 4.97 mm through the collar sleeve. The annular gap between the pipe and the inside collar was protected with a bead of Fullers Firesound sealant as shown in drawing titled "Specimen #4 110 HDPE Stack & H100S-RR", dated 15 July 2019, provided by Snap Fire Systems Pty Ltd. The pipe projected vertically, 2000-mm above from the unexposed face of the concrete slab and 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the slab. The pipe was open at the unexposed end and capped with Superwool ceramic fibre plug on the exposed end.

The specimen maintained integrity for 241 minutes duration of the test and failed insulation at 154 minutes.

A.9. Test report FSP 2050

On 2 October 2019, CSIRO North Ryde conducted a fire-resistance test on an 1150-mm x 1150-mm x 150-mm thick concrete slab penetrated by five (5) stack pipes protected by five Snap Fire Systems Cast-in fire collars.

The penetrated slab comprised a 150-mm thick concrete slab reinforced with a single layer of steel reinforcement providing a Fire Resistance Period (FRP) for insulation of 180 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'; and
- AS/NZS 4401 Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings - Polyethylene (PE).

Specimen 2 – SNAP H110S Cast-in fire collar protecting a nominal 110-mm HDPE (PE100) stack pipe.

The SNAP Cast-in H110S fire collar comprised a 1.6-mm thick polypropylene casing with a 140-mm inner diameter and a 194-mm x 184-mm base flange. The 87-mm high collar casing incorporated a layer of 451-mm long x 85-mm wide x 4-mm thick Intumescent material. The closing mechanism comprised four equally spaced steel springs held with nylon fuse links. The springs were fabricated using SPR SS315-82 grade stainless steel wire having a diameter of 3.15-mm, with the springs acting against a layer of 316-grade stainless steel mesh measuring 503-mm long x 83-mm wide as shown in drawing number H110S, dated 15 February 2019, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 111.28-mm outside diameter Vinidex PE100 HDPE pipe with a wall thickness of 4.56-mm fitted through the collar sleeve. The annular gap between the pipe and the inside collar was left unprotected. The pipe projected vertically, 2000-mm above from the unexposed face of the concrete slab and 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the slab. The pipe was open at the unexposed end and closed with a PVC end cap.

The specimen maintained integrity and insulation without failure for 241 minutes duration of the test.

A.10. Test report FSP 2116

On 15 June 2020, CSIRO North Ryde conducted a fire-resistance test on an 1150-mm x 1150-mm reinforced concrete slab penetrated by Unplasticized polyvinyl chloride (PVC-U) and high density polyethylene (HDPE) pipes protected by cast-in and retrofit Snap Fire Systems fire collars n 1150-mm

x 1150-mm x 150-mm thick concrete slab penetrated by five (5) stack pipes protected by five Snap Fire Systems Cast-in fire collars.

Specimen 4 – SNAP H100S-RR Cast-in collar protecting a Geberit HDPE SuperTube BottomTurn bend.

The SNAP Cast-in H100S-RR fire collar comprised a 1.6-mm thick polypropylene casing with a 126.5 mm inner diameter and a 213-mm diameter base flange. The 250 mm high collar casing incorporated a 412-mm x 85-mm x 4-mm thick Intumesh intumescent material and a rubber ring seal. The closing mechanism comprised three equally spaced 3.15-mm diameter galvanised steel springs bound with nylon fuse links acting against a 460-mm x 83-mm 316 stainless steel mesh as shown in drawing numbered H100S RR-T dated 29 September 2017, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 110-mm outside diameter Geberit HDPE SuperTube BottomTurn bend with a wall thickness of 5.6 mm fitted through the collar sleeve. The annular gap between the BottomTurn bend and the inside collar casing was protected with a 10-mm deep bead of Fullers Firesound mastic. On the unexposed face the BottomTurn bend was fitted with an HDPE (PE100) stack pipe as shown in drawing titled "Specimen #4, 110 HDPE SuperTube Stack & H100S-RR", dated 22 May 2020, provided by Snap Fire Systems Pty Ltd.

The stack pipe projected vertically 2000-mm above from the unexposed face of the concrete slab and the BottomTurn bend projected 500-mm into the furnace chamber. The pipe was supported at nominally 500 mm and 1500-mm from the unexposed face of the slab. The stack pipe was left open at the unexposed end and the BottomTurn bend was closed with a ceramic fibre (Superwool) plug on the exposed end.

Specimen 5 – SNAP 110R Retrofit fire collar protecting a Geberit 110 HDPE SuperTube BottomTurn bend.

The SNAP Retrofit 110R fire collar comprised a 0.75-mm steel casing with a 122 mm inner diameter and a 206-mm diameter base flange. The 62-mm high collar casing incorporated a closing mechanism that was comprised of three soft Intumesh intumescent wraps and wire meshes lined within the internal circumference of the collar. Intumescent A was 2.5-mm thick x 58-mm wide x 424-mm long, Intumescent B was 2.5-mm thick x 58-mm wide x 407-mm long and Intumescent C was 2.5-mm thick x 58-mm wide x 389-mm long. Between intumescent strips A and B was a layer of 316 stainless steel mesh 415-mm long x 58-mm wide and between intumescent strips B and C was a layer of 316 stainless steel mesh 398-mm long x 58-mm wide both had wire mesh diameters of 0.15-mm, as shown in drawing titled "SNAP 110 Retro", dated 16 January 2019, by Snap Fire Systems Pty Ltd. The Snap collar was surface mounted around the pipe on the exposed face of the slab and fixed through 3 mounting brackets using 5-mm x 30 mm Concrete Screws. The annular gap between the pipe and concrete slab on the unexposed face was protected with a bead of Fullers Firesound sealant.

The penetrating service comprised a 110-mm outside diameter Geberit HDPE SuperTube BottomTurn bend with a wall thickness of 5.6 mm fitted through the collar sleeve. A 111-mm diameter opening was cut into the slab and the collar fixed centrally over the hole. On the unexposed face the BottomTurn bend was fitted with an HDPE (PE100) stack pipe as shown in drawing titled "Specimen #5, 110 HDPE SuperTube Stack & 110R", dated 22 May 2020, provided by Snap Fire Systems Pty Ltd.

The stack pipe projected vertically, approximately 2000-mm above from the unexposed face of the concrete slab and the BottomTurn bend approximately 500-mm into the furnace chamber. The stack pipe was supported at nominally 500 mm and 1500-mm from the unexposed face of the slab. The stack pipe was left open at the unexposed end and the BottomTurn bend was closed with a ceramic fibre (Superwool) plug on the exposed end.

The two specimens maintained integrity and insulation without failure for 241 minutes duration of the test.

A.11. Test report P112838-1005

On 21 September 2018, BRE Global Ltd conducted a fire resistance test in accordance with EN1366 Part 3: 2009 on a concrete floor, nominally 1800mm x 1800mm x 150mm-thick, penetrated by 6 pipes which were protected by Suresnap H110S fire collars. Only specimen 5 is discussed in this assessment.

The Suresnap cast-in H110S fire collar comprised a 1.9-mm thick polypropylene casing with a 138-mm inner diameter and a 194-mm x 184-mm rectangular base flange. The 248-mm high collar casing, (cut down in height to match the floor thickness after casting), incorporated a 451-mm x 85-mm x 4-mm thick intumescent material and a rubber ring seal. The closing mechanism comprised four 3.15-mm diameter galvanised steel springs bound with nylon fuse links and a 503-mm x 83-mm x 0.25-mm thick stainless steel mesh.

Penetration 5 H150S cast-in collar protecting a nominal 110mm PE100 pipe stack

The penetrating service comprised a 110-mm Onorm PE100 pipe with a wall thickness of 10.0-mm fitted through the collar sleeve. The pipe projected vertically 500-mm above the concrete and 500-mm into the furnace chamber. The pipe was supported at 300-mm from the unexposed face of the concrete slab. The pipe was uncapped on both the unexposed and exposed ends. On the unexposed face, the annular gap between the pipe and slab was sealed with non-shrink grout backfill.

The result of the specimen is summarised in Appendix A12.

A.12. Summary of test reports

Test report	Pen. #	Collar Code	Element	Pipe Dia. Nominal (mm)	Pipe Type	Pipe Configuration	Notes	Integrity/ Insulation (min.)
FP 4640	2	HP100 R	150mm Concrete Slab	110	Geberit HDPE	Trap and floor grate	Electric weld above P trap and Butt weld at P-trap	-/245NF/245NF
FP 4837	1	110R	150mm Concrete Slab	110	Vinidex HDPE	Stack	Sealed with a bead of Bostik Firecaulk sealant	-/245NF/245NF
FSP 1577	1	H100S -RR	150mm Concrete Slab	110	HDPE	Stack	10mm fuller fire sound bead	-/241NF/241NF
FSP 1592	4	L100F WS	150mm Concrete Slab with 35mm screed	110	HDPE	Trap and floor grate	Butt weld at P-trap	-/241NF/241NF
FSP 1883	2	H100S -RR	120mm Bondek Slab	110	HDPE	Stack	10mm fuller fire sound bead	-/241NF/164 (Bondek)
FSP 1904	2	H150S -RR	150mm Concrete Slab	110	Valsir HDPE (4.2mm)	Stack	20mm grout backfill	-/186NF/186NF
FSP 2028	4	H100S -RR	120mm Concrete Slab	110	Vinidex HDPE	Stack	10mm fuller fire sound bead	-/241NF/154 (slab)
FSP 2050	2	H110S	150mm Concrete Slab	110	Vinidex HDPE	Stack		-/241NF/241NF
FSP 2116	4	H100S -RR	150mm Concrete Slab	110	Geberit HDPE	Stack	Butt weld unexposed side 10mm Fuller Firesound bead	-/241NF/241NF
FSP 2116	5	110R	150mm Concrete Slab	110	Geberit HDPE	Stack	Butt weld unexposed side 10mm Fuller Firesound bead	-/241NF/241NF
P112 838-1005	5	H150S -RR	150mm Concrete Slab	110	Onorm PE (10mm)	Stack	Grout backfill	-/240NF/193 (slab)

A.13. The relevance of referenced test data to AS 1530.4-2014

General

The fire resistance tests P112838-1005 was conducted in accordance with EN 1366-3: 2009 which follows the heating conditional and furnace atmosphere outlined in EN1363-1: 2012. This standard differs from AS 1530.4 2014 and the significance of these differences relevant to section 10 and is discussed below.

Temperature Regime

The furnace temperature regime for fire resistance tests conducted in accordance with AS 1530.4-2014 follows the same trend as EN 1363-1: 2012.

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4- 2014 and EN 1363-1: 2012 are not appreciably different.

Furnace Thermocouples

The furnace thermocouples specified in AS 1530.4-2014 are type K, mineral insulated metal sheathed (MIMS) with a stainless steel sheath having a wire of a diameter of not less than 1.0mm and an overall diameter of 3mm. The measuring junction protrudes at least 25mm from the supporting heat resistant tube.

The furnace thermocouples specified in EN 1363.1: 2012 (plate thermometers) are made from folded steel plate that faces the furnace chamber. A thermocouple is fixed to the side of the plate facing the specimen with the thermocouple hot junction protected by a pad of insulating material. The plate part is to be constructed from 150 ±1 mm long by 100 ±1 mm wide by 0.7 ±0.1 mm thick nickel alloy sheet strips.

The measuring junction is to consist of nickel-chromium/nickel aluminium (Type K) wire as defined in IEC 60584-1, contained within mineral insulation in a heat-resisting steel alloy sheath of nominal diameter 1 mm, the hot junctions being electrically insulated from the sheath.

The thermocouple hot junction is to be fixed to the geometric centre of the plate, by a small steel strip made from the same material as the plate. The steel strip can be welded to the plate or may be screwed facilitate the replacement of the thermocouple. The strip should be approximately 18 mm by 6 mm if it is spot-welded to the plate, and nominally 25 mm by 6 mm if it is to be screwed to the plate. The screw is to be 2 mm in diameter.

The assembly of plate and thermocouple should be fitted with a pad of inorganic insulation material 97 ±1 mm by 97 ±1 mm by 10 ±1 mm thick with a density of 280 ±30 kg/m3.

The relative location of the furnace thermocouples for the exposed face of the specimen, for AS 1530.4-2014 and EN 1363.1: 2012, is 100mm ±10mm and 100mm ±50mm respectively.

The furnace control thermocouples required by EN 1363.1: 2012 are less responsive than those specified by AS 1530.4-2014. This variation in sensitivity can produce a potentially more onerous heating condition for specimens tested to EN 1363.1: 2012, particularly when the furnace temperature is changing quickly in the early stages of a test.

Furnace Pressure

It is a requirement of AS 1530.4-2014 and for EN 1363-1: 2012 that for horizontal elements, a furnace gauge pressure of 20Pa is established at a height 100mm below the floor soffit level.

The parameters outlining the accuracy of control of the furnace pressure in AS 1530.4-2014 and EN 1363-1: 2012 are also not appreciably different.

Specimen Configuration

AS 1530.4-2014 specifies that the service(s) shall be installed so that they project a minimum 500mm on the exposed side of the supporting construction and for plastic pipes 2000mm on the non-exposed

side of which at least 200mm shall extend beyond the extremities of the penetration sealing system. The penetration sealing system shall include any coating, wrapping or other protections to the services.

EN 1366-3: 2009 specifies that a penetration shall be installed so that it projects a minimum of 500mm on each side of the support construction, of which at least 150mm shall extend beyond the extremities of protection seal. Also, it allows pipes to be tested in any of the configurations below to suit the final application.

In the referenced P112838-1005 report, all of the pipes were tested uncapped on both sides of the wall, with 500mm extension of pipe on each side of the wall. Generally, the longer pipe extension required by AS 1530.4-2014 increases the differential pressure across the collar for the duration of the test, particularly after a gap forms in the pipe on the fire side. Where there is sufficient evidence to correlate the performance of the plastic pipes and collars for a 500mm extension and 2000mm extension it is possible to confirm the 500mm is representative on a case by case basis.

Specimen thermocouples

The specimen thermocouple specification for service penetrations is generally the same for AS 1530.4-2014 and EN 1363.1: 2012 and EN 1366-3: 2009.

For the penetration construction considered, AS1530.4-2014 specifies the following locations for thermocouples to be placed:

- At not less than two points located approximately 25mm from the edge of the hole made for the passage of the service (one in the uppermost vertical plane).
- On the surface of the penetrating service, at least two thermocouples located approximately 25mm from the plane of the general surface of the penetrated element (one in the uppermost vertical plane).
- At least two positions 25 mm from the interface of the separating element and the main penetration seal.

For penetration sealing systems, EN 1363.1: 2012 specifies thermocouples are fixed in generally similar locations on the unexposed face: on the supporting construction and/or seal and on the penetrating service adjacent at the plane of penetration, and on the penetrating service some distance from the plane of penetration.

Based on the above, the effect of the differences on the thermocouple locations of the tested construction and the specifications in AS 1530.4-2014 is discussed on a case by case basis.

Criteria for failure

Specimens shall be deemed to have failed the integrity criterion in accordance with AS 1530.4-2014 when any of the following occur:

- sustained flaming for 10 seconds.
- a gap forms that allows the passage of hot gases to the unexposed face and ignite the cotton pad when applied for up to 30 seconds.
- a gap forms that allow the penetration of a 25mm gap gauge anywhere on the specimen.
- a gap forms that allow a 6mm × 150mm gap gauge to penetrate the specimen anywhere on the specimen.

Performance criteria in accordance with EN 1363 – 1: 2012:

Integrity: Failure, is deemed to occur:

a) when sustained flaming for not less than 10s on the unexposed face occurs;
b) when cracks, gaps or fissures allow flames or hot gases to cause flaming or glowing of a cotton fibre pad;

c) when a 6mm-diameter gap gauge can penetrate through a gap into the furnace and be moved in the gap for a distance of at least 150mm, or a 25mm- diameter gap gauge can penetrate through a gap into the furnace.

Insulation: Failure is deemed to occur:

a) when the temperature recorded at any position on the unexposed face is in excess of 180°C above the initial mean unexposed face temperature;
b) when integrity failure occurs.

The criteria for the referenced tests are not significantly different for tests undertaken in accordance with EN 1363-1: 2012 and Section 10 of AS 1530.4-2014.

Conclusion

The variations in furnace heating regimes, furnace thermocouples and the responses of the different thermocouple types to the furnace conditions are not expected to have a significant effect on the outcome of the referenced fire resistance test.

The differences in specimen configuration will affect the overall performance of the specimen. The relevant specimens' will be examined on an individual basis in Appendix B.

With regards to the service penetration of interest in this report is P112838-1005 specimen 5, the pipe extensions on the non-fire side were 500mm away from the floors rather than 2000mm required by AS 1530.4-2014.

Theoretically, this difference in extension can affect the drawing of hot gases through the pipe by a 'stack effect' and can lead to high temperatures on the non-fire side of the specimen than for a shorter pipe extension.

The impact of the stack effect on the tested services can be significant when there are gaps at the penetrations and hot gases are passing in the pipes and in particular for floor specimens. The longer the length of the pipe above the collar is the greater the increase in pressure across the collar or gap. In another word, if gaps are present, the stack effect would render the pipe configuration in AS 1530.4 -2014 to be more onerous than that in EN1363-1: 2012.

With reference to P112838-1005 specimen 5, the pipe was also tested uncapped on the exposed side and the unexposed side. Around 17 minutes, the H150S collars was able to fully activate and filled the aperture thereby reducing the smoke emissions. After this, specimen 5 did not vent volumes of smoke for up to 240 minutes. Specimens 5 was able to maintain integrity for 240 minutes.

The significance of the above observation is that the performance of P112838-1005 specimen 5 prior to the formation of gaps and smoke emission indicates that for the period up to 240 minutes, the influence of the stack effect would be minimal.

Based on the above discussion, the test identified above is confirmed by this Accredited Testing Laboratory to be equivalent or more severe than a Standard Fire Test in accordance with the test standard specified in Section 4 of this report when applied to the specimen identified above. Based on the above discussion it is considered that the results relating to the integrity and insulation performance of the referenced EN1366-3:2009 tests are applicable up to 240 minutes when tested in accordance with AS 1530.4-2014 and when assessed in accordance with AS 4072.1 -2005.

Appendix B Analysis of Variations

B.1 Variation to pipe configuration

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

- The L100FWS tested in FSP 1592 specimen 4 shall be applied to stack applications
- The HP100R tested in FP 4640 specimen 2 shall be applied to stack applications

The proposed variations require the replacement of floor waste grate with a 2m long piece of pipe that extends above the slab, such that the pipe is now a stack pipe configuration rather than a floor waste configuration.

With reference to FSP 1592 specimen 4, a 110mm diameter HDPE pipe penetrated a 150mm slab. It was protected by a cast in L100FWS collar on the exposed side and was butt welded to a 110-mm OD HDPE gully trap that was filled partially with water. The floor waste system was capped on the unexposed face with chromed brass floor waste grate, a 35-mm thick cement screed was laid on top of the concrete slab and finished flush with the floor grate. The specimen maintained integrity and insulation without failure for 241 minutes duration of the test. As side from an initial temperature spike at the start of the test, the grate and the screed remained under 100^{o}C for the 241 minutes duration of the test.

With reference to FP 4640 specimen 2, a 110mm diameter Geberit HDPE pipe penetrated a 150mm slab. It was protected by a retrofitted HP100R collar on the exposed side and was butt welded to a 110-mm OD HDPE gully trap that was not filled with water. The floor waste system was capped on the unexposed face with ABS floor waste grate and sealed to the slab with a bead of Sika Fire sealant. The specimen maintained integrity and insulation without failure for 241 minutes duration of the test. As side from an initial temperature spike at the start of the test, the grate and the screed remained under 125^{o}C for the 241 minutes duration of the test.

This will result in a “stack effect” offered by the 2m long extension of the pipe that will pull hot gases through the pipe away from the base of the pipe. Also, the temperature measured on the grate in FSP 1592 specimen 4 and FP 4640 specimen 2 is not particularly high, indicating that the temperature in the pipes is relatively low for the 240 minutes duration of the test. Therefore, it is expected that the pipe at 25mm from the slab will be able to maintain integrity and insulation for 240 minutes duration of the test.

The variation of floor waste to stack configuration for FSP 1592 specimen 4 will result in the removal of the 35mm screed. This may result in higher temperatures on the slab substrate. However, FP 4640 specimen 2 gives confidence that the 150mm slab will be able to maintain insulation for up to 240 minutes.

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.

B.2 Variation to pipe material

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

- The 110mm HDPE pipes tested will be replaced with a Geberit Sovent
- The 110mm HDPE pipes tested will be replaced with a Geberit Supertube BottomTurn where the fitting is installed as high into the collar as practical
- The Geberit Sovent and Geberit Supertube BottomTurn may be butt welded to the Geberit Supertube piping with a nominally 3mm weld where the weld is formed by a hot plate between two pipe sections, then removed letting the pipes fuse.
- The butt joint and sleeve/coupling for Sovent or Supertube may be anywhere in the collar.

Table: B1

Test report	Pen. #	Collar Code	Element	Pipe Dia. Nominal (mm)	Pipe Type	Pipe Configuration	Notes	Integrity/ Insulation (min.)
FSP 1577	1	H100 S-RR	150mm Concrete Slab	110	HDPE	Stack	10mm fuller fire sound bead	-/241NF/241NF
FSP 2028	4	H100 S-RR	120mm Concrete Slab	110	Vinidex HDPE	Stack	10mm fuller fire sound bead	-/241NF/154 (slab)
FSP 2116	4	H100 S-RR	150mm Concrete Slab	110	Geberit Supertube BottomTurn HDPE pipe	Stack	Butt weld unexposed side 10mm Fuller Firesound bead	-/241NF/241NF
FP 4837	1	110R	150mm Concrete Slab	110	Vinidex HDPE	Stack	Sealed with a bead of Bostik Firecaulk sealant	-/245NF/245NF
FSP 2116	5	110R	150mm Concrete Slab	110	Geberit Supertube BottomTurn HDPE pipe	Stack	Butt weld unexposed side 10mm Fuller Firesound bead	-/241NF/241NF

Table B1 shows that there is little difference between the different brands of 110mm diameter HDPE pipe tested. Therefore, it is expected that the replacement with a Geberit Sovent pipe for the tested 110mm HDPE pipes in section A11, will not detrimentally affect their performance for up to 240 minutes.

Table B1 also shows that having a Supertube BottomTurn configuration on the exposed side does not affect the closure of the collar, as the HDPE pipe is melted away in the early stage of the regardless of its shape.

The proposed variation to move the butt weld from outside the collar as tested the tests shown in Table B1, to inside the collar. The process of butt weld will result in a nominally 3mm weld lip on the pipe inside the collar. It is not expected that this small lip will affect the closure of the collars to detrimentally affect the integrity and insulation performance of the pipe for up to 240 minutes.

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.

B.3 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 separating element shall be 120mm Bondek for -/240/120 applications.
- The separating element shall be 150mm concrete for -/240/180 applications.
- The separating element shall be 170mm concrete for -/240/240 applications.
- Annular gap between the pipe and the inside collar casing or pipe and floor substrate to be sealed with 10mm depth of Fuller Firesound sealant.

With reference to FSP 1883 specimen 2, it demonstrated that a Bondek, when penetrated by an HDPE pipe that can be closed off by a cast-in collar for 240 minutes, will also be able to maintain integrity at the perimeter seal between the pipe and cast-in collar when sealed with 10mm bead of fuller fire sound for up to 240 minutes.

With reference to FP 4837 specimen 1, it demonstrated that a 150mm slab, when penetrated by an HDPE pipe that can be closed off by a retrofit collar for 240 minutes, will also be able to maintain integrity at the 1mm annular between the pipe and slab when the annular gap is sealed with a bead of Bostik Firecaulk sealant for up to 240 minutes.

The temperature profiles of the pipes tested test reports in section A11 showed that the pipes were all able to remain under 125oC for up to 240 minutes, which demonstrated that the various collars tested were able to close off the 110mm HDPE pipes for 240 minutes.

Most of the sealant measurements also were relatively cool and were able to maintain insulation for 240 minutes, with the hottest been measured on FSP 1883 specimen 2, where the sealant only had a 168^{o}C temperature rise at 240 minutes.

All the proposed substrate are either the same or thicker than that tested in FSP 1883 specimen 2, and so able to provide more head sink effect offered by the increase in concrete mass. Therefore, it is expected that the sealant measurements on these thicker substrates will also be able to maintain integrity and insulation for 240 minutes.

The test results in Section A11 also demonstrated the ability for the 120mm Bondek to maintain insulation for at least 120 minutes when penetrated by HDPE pipe and collar. It also demonstrated the ability for 150mm concrete slab and 170mm concrete slab to maintain insulation for at least 240 minutes when penetrated by HDPE pipe and collar.

The increase of slab thickness will increase the heat sink effect offered by the slab, allowing the unexposed side of the specimen and the slab to achieve better insulation performance.

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 120mm Bondek will be able to maintain integrity and insulation for up to 240 minutes and 120 minutes respectively when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1 -2005.

Based on the above, it is expected that the proposed 150mm concrete slab will be able to maintain integrity and insulation for up to 240 minutes and 180 minutes respectively when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1 -2005.

Based on the above, it is expected that the proposed 170mm concrete slab 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.

B.4 Inclusion of sleeve/coupling

The proposed variation to include a sleeve/coupling inside the collar may affect and or delay collar closure. With reference to P112838-1005 specimen 5, the H150S collar was able to close a 110mm PE pipe with a wall thickness of 10mm in 17 minutes and maintained a temperature of less than 100°C on the pipe, while the same collar in FSP 1904 was able to close off a 110mm HDPE pipe with a wall thickness of 4.2mm in 7 minutes and the pipe did not reach 40°C.

The significance of the above comparison shows that the H150S collar takes more time to close a 10mm PE pipes than a 4.2mm HDPE. It is expected that when a HDPE pipe is contained in a sleeve/coupling within the H150S collar and other proposed collars. The margin over insulation failure on both tested collars is enough to accommodate for the slightly delayed closure time caused by the presence of sleeve/coupling without failure. Based on the above it is considered there is sufficient confidence in the closure speed of the collar, it will occur prior to insulation failure on the pipe above the collar.

Based on the above, it is considered that the proposed variation will not detrimentally affect the integrity and insulation performance of the proposed collars 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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