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Fire assessment report

The fire resistance performance of linear gap sealing systems in aerated concrete walls if tested in accordance with AS1530.4:2014 and assessed in accordance with AS 4072.1:2005

Report sponsor: Soudal NV

Report number: 23751 Revision: R5.1 Reference number: FAS200098

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Amendment schedule

Version	Date	Information relating to report			
00	Issue: 27/07/2009	Reason for issue	Initial Issue		
			Prepared by	Reviewed by	Approved by
		Name	M. Kamal	K. Nicholls	
01	Issue: 31/03/2016	Reason for issue	Updated referenced standard		
			Prepared by	Reviewed by	Approved by
		Name	D. Nicholson	K. Nicholls	
02	Issue: 17/06/2016	Reason for issue	Revised to correct typographical error		
			Prepared by	Reviewed by	Approved by
		Name	D. Nicholson	S. Hu	
03	Issue: 04/07/2018	Reason for issue	Revised to update table in section 5		
			Prepared by	Reviewed by	Approved by
		Name	O. Saad	H. Wong	
04	Issue: 16/10/2018	Reason for issue	Revised to include report co-sponsor, addition of Wurth product names and new contact information.		
			Prepared by	Reviewed by	Approved by
		Name	H. Wong	M. Akl	
R5.0	Issue: 11/06/2020	Reason for issue	Issued to update the report with removing the sealant combination of Silirub FR B1 with PU backing rods and further extend the validity of the report by five years.		
			Prepared by	Reviewed by	Approved by
		Name	Imran Ahamed	Mahmoud Akl	Mahmoud Akl
R5.1	Issue: 18/06/2020	Reason for issue	Report issued after removing Wurth products from the report.		
			Prepared by	Reviewed by	Approved by
	Expiry: 31/03/2026	Name	Imran Ahamed	Mahmoud Akl	Mahmoud Akl
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The data, methodologies, calculations and results documented in this report specifically relate to the tested/assessed specimen/s and must not be used for any other purpose.

All work and services carried out by Warringtonfire Australia are subject to and conducted in accordance with our standard terms and conditions. These are available on request and at https://www.element.com/terms/terms-and-conditions.

Executive summary

This report presents an assessment of the fire resistance performance of linear gap sealing systems in aerated concrete walls if tested in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005 (R2016).

The tested prototypes described in section 3.2 of this report, when subjected to the proposed variations described in section 3.3, and tested in accordance with the referenced method described in section 3.4, are likely to achieve the outcomes described in section 5.4 and the fire resistance performance described in Table 1.

Table 1 Assessment summary

ID	Wall thickness (mm)	Gap width (mm)	Seal depth (mm)	Sealant	Backing material	Seal location	FRL
A	200	30	200	Soudafoam FR	None	Both faces	-/120/120
B	200	25	25	Firecryl FR	Soudaform FR	Exposed	-/240/240
C	200	15	15	Soudaseal FR	PE- Backer Rod	Exposed	-/240/240
D	200	15	15	Firecryl FR	PE- Backer Rod	Exposed	-/240/240
E	200	10	200	Soudafoam FR	None	Both faces	-/240/240
G	200	40	20	Soudaseal FR	Soudafoam FR and Firecryl FR	Exposed	-/240/240
H	200	30	20	Soudaseal FR	PE- Backer Rod	Both faces	-/240/240
I	200	30	20	Soudaseal FR	Soudafoam FR	Exposed	-/240/240
J	200	15	15	Firecryl FR	Soudafoam FR	Exposed	-/240/240
K	200	25	20	Soudaseal FR	Soudafoam FR	Exposed	-/240/240
Note: The width of the joint may be reduced with no change to the seal depth, sealant type, backing materials and sealant location.							

The variations and outcome of this assessment are subject to the limitations and requirements described in sections 2, 4 and 6 of this report. The results of this report are valid until 31 March 2026.

Contents

1. Introduction

This report presents an assessment of the fire resistance performance of linear gap sealing systems in aerated concrete walls if tested in accordance with AS 1530.4:2014[1] and assessed in accordance with AS 4072.1:2005 (R2016)[2].

This assessment was carried out at the request of Soudal NV. The sponsor details are included in Table 2.

Table 2 Sponsor details

Sponsor	Address
Soudal NV	Everdongenlaan 18-20 B-2300 Turnhout Belgium

2. Framework for the assessment

An assessment is an opinion about the likely performance of a component or element of structure if it were subject to a standard fire test.

No specific framework, methodology, standard or guidance documents exists in Australia for doing these assessments. We have therefore followed the Guide to Undertaking Assessments In Lieu of Fire Tests prepared by the Passive Fire Protection Federation (PFPF) in the UK[3].

This guide provides a framework for undertaking assessments in the absence of specific fire test results. *'Some areas where assessments may be offered are:*

- *Where a modification is made to a construction which has already been tested*
- *The interpolation or extrapolation of results of a series of fire resistance tests, or utilisation of a series of fire test results to evaluate a range of variables in a construction design or a product*
- *Where, for various reasons – eg size or configuration – it is not possible to subject a construction or a product to a fire test.'*

Assessments will vary from relatively simple judgements on small changes to a product or construction through to detailed and often complex engineering assessments of large or sophisticated constructions.

2.1 Requirements of the assessment

- This report details the methods of construction, test conditions and assessed results that would have been expected had the specific elements of construction described herein been tested in accordance with AS 1530.4:2014.
- The supporting wall construction shall be capable of providing effective support of the proposed construction for the required fire resistance period (FRL).
- The service penetrations shall be continuous or otherwise supported and shall not rely upon the seal only.
- Any further variations with respect to size, constructional details, loads, stresses, edge or end conditions, other than those identified in this report, may invalidate the conclusions drawn in this report.

[1] Standards Australia, 2014, *Methods for fire tests on building materials, components and structures: Fire-resistance tests for elements of construction*, AS 1530.4:2014, Standards Australia, NSW
[2] Standards Australia, 2005, *Components for the protection of openings in fire-resistant separating elements: Service penetrations and control joints*, AS 4072.1-2005 (R2016), Standards Australia, NSW
[3] Passive Fire Protection Forum (PFPF) 2019, *Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence*, Passive Fire Protection Forum (PFPF), UK

2.2 Declaration

The guide to undertaking assessments in lieu of fire tests prepared by the PFPF in the UK requires a declaration from the client. By accepting our fee proposal dated 21 April 2020, Soudal NV confirmed that

- To their knowledge the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the standard against which this assessment is being made.
- They agree to withdraw this assessment from circulation if the component or element of structure is the subject of a fire test by a test authority in accordance with the standard against which this assessment is being made and the results are not in agreement with this assessment.
- They are not aware of any information that could adversely affect the conclusions of this assessment and – if they subsequently become aware of any such information, they agree to ask the assessing authority to withdraw the assessment.

3. Description of the specimen and variations

3.1 System description

The assessed systems consist of various linear seals of different widths in 200 mm thick aerated concrete wall – with a stated density of 550 kg/m^3. The linear seals are protected using combinations of one or more Soudafoam FR, Firecryl FR and Soudaseal FR sealants.

3.2 Referenced test data

The assessment of the variation to the tested system and the determination of the likely performance is based on the results of the fire test report 13492A which describes a fire resistance test performed on various linear gap sealing systems when installed in vertically and horizontally orientated gaps within aerated concrete wall. Soudal NV has granted permission for Warringtonfire to use the test data to prepare this assessment report. Further details of the tested system are described in Appendix B.

3.3 Variations to the tested systems

Identical systems have not been subjected to standard fire tests in accordance with AS 1530.4:2014. We have therefore assessed the systems using baseline test information for similar systems. The variations to the tested systems together with the referenced baseline standard fire tests are described in Table 3.

Table 3 Variation to tested systems

Item no.	Reference test	Description	Variations
1	13492A	The referenced fire resistance test was conducted in accordance with EN 1363-1:1999[4] and EN 1366-4:2006[5]. The test demonstrates the fire resistance performance of Soudafoam FR, Firecryl FR and Soudaseal FR sealants.	The proposed variation is to assess the likely fire resistance performance of linear seals if tested in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016).

[4] European Committee for Standardization, 1999, *Fire resistance tests - Part 1: General requirements*, EN 1363-1:1999, European Committee for Standardization, Brussels, Belgium

[5] European Committee for Standardization, 2006, *Fire resistance tests for service installations. Linear joint seals*, EN 1366-4:2006, European Committee for Standardization, Brussels, Belgium

3.4 Purpose of the test method

Section 2 of AS 1530.4:2014 specify the general requirements for conducting fire resistance tests. Section 10 of AS 1530.4:2014 give guidelines for determining the fire resistance of elements of construction penetrated by services such as control joints. As per section 10.3 of AS 1530.4:2014, the purpose of the test covering service penetrations and control joints is to assess-

- The effect of the penetration or control joint on the integrity and insulation of the element
- Insulation or integrity failure of the penetrating service or control joint

AS 4072.1:2005 (R2016) sets out the minimum requirements for the construction, installation and application of fire resistance tests to sealing systems. These include control joints between building elements that are required to have a fire resistance level (FRL).

3.5 Schedule of components

Table 4 outlines the schedule of components for the assessed systems subject to a fire test, as referenced in Appendix B. The sealant configurations are given in Figure 1.

Table 4 Schedule of components of assessed systems

Item	Description
1	Soudaform FR – one component self-expanding, ready to use polyurethane form
2	Firecryl FR – fire retardant, intumescent plasto-elastic sealant based on acrylic dispersions
3	Soudaseal FR – high quality, neutral, one-component sealant/adhesive based on the SMX-technology
4	Silirub FR B1 – high quality, neutral, elastic one-component sealant based on silicones
5	PE-Backer rod – 20 mm diameter round profile in extruded closed cell polyurethane form
6	PE-Backer rod – 30 mm diameter round profile in extruded closed cell polyurethane form
7	PE-Backer rod – 40 mm diameter round profile in extruded closed cell polyurethane form

4. Scope, objective and assumptions

- The scope of this report is limited to an assessment of the variations to the tested systems described in section 3.3.
- This report details the methods of construction, test conditions and assessed results that would have been expected if the specific elements of construction described here had been tested in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016).
- The results of this assessment are applicable to linear seals in walls exposed to fire from either side, but not simultaneously.
- This report is only valid for the assessed systems. Any changes with respect to size, construction details, loads, stresses, edge or end conditions, other than those identified in this report, may invalidate the findings of this assessment. If there are changes to the system, a reassessment will be needed to verify consistency with the assessment in this report.
- This report has been prepared based on information provided by others. Warringtonfire has not verified the accuracy and/or completeness of that information and will not be responsible for any errors or omissions that may be incorporated into this report as a result.

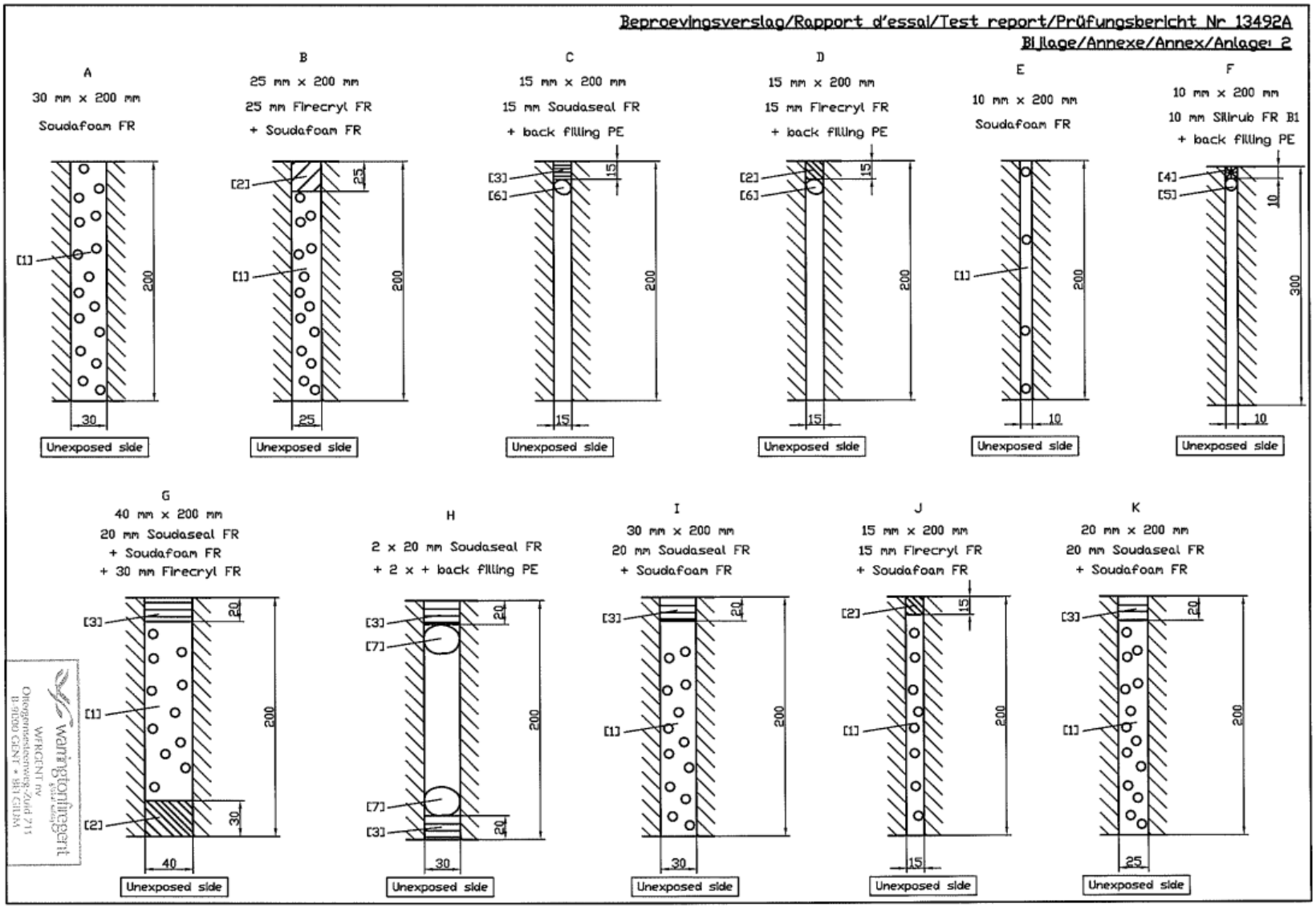

Figure 1 Tested sealant configurations

5. Assessment of likely fire performance with respect to AS 1530.4:2014 and AS 4072.1:2005 (R2016)

5.1 Description of variation

The assessment refers to fire test report 13492A, which consisted of 11 various linear seals in an aerated concrete wall. The linear seals were protected using combinations of one or more Soudafoam FR, Firecryl FR and Soudaseal FR sealants. The test was conducted in accordance with EN 1366-4:2006 and EN 1363-1:1999 and thus it has been proposed to assess the likely fire resistance performance of these linear seals in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016).

5.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 5.

Table 5 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Comparative

5.3 Assessment

The referenced fire test report 13492A was conducted in accordance with EN 1366-4:2006 and EN 1363-1:1999. These standards slightly differ from AS 1530.4:2014 and AS 4072.1:2005 (R2016). Therefore, the effect of these differences on the fire resistance performance of tested linear seals are discussed below.

5.3.1 Furnace temperature measurement

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 diameter of less than 1.0 mm and an overall diameter of 3 mm. The measuring junction protrudes at least 25 mm from the supporting heat resistant tube.

The furnace thermocouple specified in EN 1363.1:1999 is 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 to it to facilitate 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 1363.1:1999, is 100 mm + 10 mm and 100 mm + 50 mm, respectively.

Therefore, the furnace control thermocouples required by EN 1363.1:1999 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 1363.1:1999, particularly when the furnace temperature is changing quickly in the early stages of the test.

5.3.2 Furnace pressure regime

It is a requirement of AS 1530.4:2014 that for vertical elements with more than 1 m height, a furnace pressure of 20 ± 3 Pa shall be established at the top of the separating element and all the penetration services shall have a pressure greater than 10 Pa.

Similarly, as per EN 1366-4:2006, a vertical furnace shall be operated so that a minimum pressure of 15 Pa exists in the centre of the test specimen mounted in the lowest position.

Test report shows that pressure at mid height of the vertical specimen is 15 Pa. Considering 8 Pa/m rise in pressure, the pressure at the top and bottom of the specimen will be 19.8 Pa and 10.2 Pa, respectively. Both these values are more onerous pressure requirements of AS 1530.4:2014

The parameters outlining the accuracy of control of the furnace pressure in AS 1530.4:2014 and EN 1363-1:1999 are also not appreciably different.

5.3.3 Specimen size

EN 1366-4:2006 states that a linear joint seal shall be of uniform design cross sectional area. For non-movement joints, a shorter length of not less than 900 mm can be used.

AS 1530.4:2014 states that the length of the linear seal exposed to the furnace chamber shall not be less than 1 m. The linear seals tested in the reference test reports all have a length of 1.2 m. Therefore, they are compliant with the Australian Standards' requirements.

5.3.4 Specimen temperature measurement

For linear seals, AS 1530.4:2014 specifies the following requirements when placing thermocouples on the unexposed face in clause 10.5.1 (f).

- At least three on the surface of the seal, with one thermocouple for each 0.3 m^2 of surface area, up to a maximum of five, uniformly distributed over the area (one thermocouple being located at the centre of the seal)
- On the surface of the seal, 25 mm from the edge of the opening, with one thermocouple for each 500 mm of the perimeter.
- On the surface of the separating element, 25 mm from the edge of the opening, with one thermocouple for each 500 mm of the perimeter.

Furthermore, clause 10.5.3 of AS 1530.4:2014 specifies that thermocouples used for the evaluation of the insulation performance of linear seals shall be positioned on the unexposed face of the sealing system and the separating element, except where the unexposed face of the seal is recessed within the separating element. Where this occurs, thermocouples shall only be fitted to the seal when the joint width is greater than or equal to 12 mm. Under such circumstances, the size of the pad may be reduced to facilitate the fitting of the thermocouple.

EN 1366-4:2006 specifies that at least three thermocouples to be located at the centre line of the linear joint seals, and four on separating element only 15 mm from the edge. Other thermocouples may be applied where the laboratory personnel consider it necessary – as evenly as possible – where the temperature reached is thought to be higher than elsewhere.

A review of EN 1366-4:2006 thermocouple requirements show that while the unexposed surface thermocouple locations specified are in agreement with those specified in AS 1530.4:2014, the former is more onerous in certain aspects.

5.3.5 Integrity performance criteria

The specimen shall be deemed to have failed the integrity criterion in accordance with AS 1530.4:2014 if it collapses or sustains flaming or other conditions on the unexposed face, which ignite the cotton pad when applied for up to 30 seconds. Gap gauges are not used to evaluate integrity.

Except for minor technical variations, the integrity criteria in EN 1363-1:1999 are generally applied in a comparable manner.

5.3.6 Insulation performance criteria

Failure in relation to insulation shall be deemed to have occurred when the temperature of any of the relevant thermocouples of the unexposed face of the test specimen rises by more than 180°C above the initial temperature. The integrity and insulation criteria specified in EN 1366-4:2006 are not appreciably different from AS 1530.4:2014.

Application of test data to AS 1530.4:2014

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 significant effect on the outcome of the referenced fire resistance test. The relative locations of the specimen thermocouples are similar. However, EN 1366-4:2006 requires thermocouples to be placed 15 mm from the edge whereas AS 1530.4:2014 requires those to be placed 25 mm from the edge of the seal. As these thermocouples are closer to the linear seal, test results in accordance EN 1366-4:2006 are considered to be more onerous than those to AS 1530.4:2014.Based on the above discussion it is considered that the results relating to the integrity and insulation performance of the tested linear seals in 13492A can be used to assess the FRL in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016).

5.4 Conclusion

This assessment demonstrates that the linear seals that was tested in 13492A are likely to achieve the FRLs shown in Table 6, if tested in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016).

Table 6 Assessment summary

ID	Wall thickness (mm)	Gap width (mm)	Seal depth (mm)	Sealant	Backing material	Seal location	FRL
A	200	30	200	Soudafoam FR	None	Both faces	-/120/120
B	200	25	25	Firecryl FR	Soudaform FR	Exposed	-/240/240
C	200	15	15	Soudaseal FR	PE- Backer Rod	Exposed	-/240/240
D	200	15	15	Firecryl FR	PE- Backer Rod	Exposed	-/240/240
E	200	10	200	Soudafoam FR	None	Both faces	-/240/240
G	200	40	20	Soudaseal FR	Soudafoam FR and Firecryl FR	Exposed	-/240/240
H	200	30	20	Soudaseal FR	PE- Backer Rod	Both faces	-/240/240
I	200	30	20	Soudaseal FR	Soudafoam FR	Exposed	-/240/240
J	200	15	15	Firecryl FR	Soudafoam FR	Exposed	-/240/240
K	200	25	20	Soudaseal FR	Soudafoam FR	Exposed	-/240/240
Note: The width of the joint may be reduced with no change to the seal depth, sealant type, backing materials and sealant location.							

6. Validity

Warringtonfire Australia does not endorse the tested or assessed product in any way. The conclusions of this assessment may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all conditions.

Due to the nature of fire 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 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 subject to constant review and improvement. It is therefore recommended that this report be reviewed on or, before, the stated expiry date.

This assessment represents our opinion about the performance likely to be demonstrated on a test in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016), based on the evidence referred to in this report.

This assessment is provided to the Soudal NV for its own purposes and we cannot express an opinion on whether it will be accepted by building certifiers or any other third parties for any purpose.

Appendix A Drawings and information

Drawing title	Drawn
Tested sealant configurations	Extracted from the test report 13492A

Appendix B Summary of supporting test data

B.1 Test report – 13492A

Table 7 Information about test report

Item	Information about test report
Report sponsor	Soudal NV, Everdongenlaan 18-20, B-2300 Turnhout, Belgium.
Test laboratory	WFRGENT NV, Ottergemsesteenweg- Zuid 711, B- 9000 Gent, Belgium.
Test date	The fire resistance test was completed on 25/11/2008.
Test standards	The test was done in accordance with EN 1363-1:1999 and EN 1366-4:2006.
General description of tested specimen	The tested specimen consisted of nine vertically orientated and two horizontally oriented linear seals in a 200 mm thick aerated concrete wall. The linear seals were sealed with different sealing systems as shown in Table 8.
Instrumentation	The test report states that the instrumentation was in accordance with EN 1366-4:2006.

Table 8 Tested sealant configurations

ID	Wall thickness (mm)	Gap width (mm)	Seal depth (mm)	Sealant	Backing material	Seal location
A	200	30	200	Soudafoam FR	None	Both faces
B	200	25	25	Firecryl FR	Soudaform FR	Exposed
C	200	15	15	Soudaseal FR	PE-Backer Rod	Exposed
D	200	15	15	Firecryl FR	PE-Backer Rod	Exposed
E	200	10	200	Soudafoam FR	None	Both faces
G	200	40	20	Soudaseal FR	Soudafoam FR and Firecryl FR	Exposed
H	200	30	20	Soudaseal FR	PE-Backer Rod	Both faces
I	200	30	20	Soudaseal FR	Soudafoam FR	Exposed
J	200	15	15	Firecryl FR	Soudafoam FR	Exposed
K	200	25	20	Soudaseal FR	Soudafoam FR	Exposed

The test specimen achieved the results shown in Table 9.

Table 9 Results summary

ID	Integrity (min)		Insulation (min)
	Cotton pad	Sustained flaming	
A	158	162	163*
B	240*	240*	240*
C	240*	240*	240*
D	240*	240*	240*
E	240*	240*	240*
G	240*	240*	240*
H	240*	240*	240*
I	240*	240*	240*
J	240*	240*	240*

K	240*	240*	240*
* No failure observed during the test duration.			