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ASSESSMENT REPORT

The likely fire resistance performance of various expansion joints in Speedpanel wall system incorporating PROMASEAL® FyreStrip if tested in accordance with AS1530.4-2014 and AS4072.1:2005

Client: Speedpanel Holdings Pty Ltd, 421 Dorset Road, Bayswater VIC 3153

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	Expiry: 31/05/2024	Name	Rami Al Darwish	Hon Wong	Hon Wong
		Signature			

Contact Information

Warringtonfire Australia Pty Ltd - ABN 81 050 241 524

NATA Registered Laboratory
Unit 2, 409-411 Hammond Road
Dandenong Victoria 3175
Australia
T: +61 (0)3 9767 1000

General conditions of use

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1. Introduction

This report presents an assessment of the likely fire resistance performance of various expansion joints in Speedpanel wall incorporating PROMASEAL® FyreStrip if tested in accordance with AS1530.4-2014.

The tested prototypes described in Section 2 of this report, when subject to the proposed variations described in Section 3, are to perform satisfactorily if tested in accordance with the referenced test method described in Section 4. The conclusions of the report are summarised in Section 5.

The validity of this assessment is conditional on compliance with Sections 7, 8 and 9 of this report.

Summaries of the test data on which this assessment is based are provided in Appendix A. A summary of the critical issues leading to the assessment conclusions including the main points of argument are included in Appendix B.

2. Tested prototypes

This assessment is based on fire resistance tests FT 10-95 and EWFA 2517300.2.

The testing was sponsored by Fyreguard Pty. Ltd. and Speedpanel Pty. Ltd. and was undertaken by CSR Gyprock Bradford Research Centre and Warringtonfire Aus Pty Ltd.

Permission has been provided by Promat Pty. Ltd. (on behalf of Fyreguard Pty. Ltd) to refer to FT 10-95 on behalf of Speedpanel. For the purpose of this report, data considered from this fire resistance test is summarised in Appendix A.

3. Variation to tested prototypes

PROMASEAL® FyreStrip Control Joints

The proposed construction shall be as tested in FT10-95, if tested in accordance with AS1530.4-2014 subject to the following variations:

- Change of the support construction tested in FT10-95 from plasterboard lined wall to Speedpanel and the inclusion of a cover strip of 16mm Boral Firestop, 16mm Powerscape or 20mm Promatect 100 on each side in conjunction with FyreStrip joint as depicted in Figures 1-2.
- Similar details for a T-Junction with Speedpanel or masonry or concrete wall of at least 120/120/120 or -/120/120.

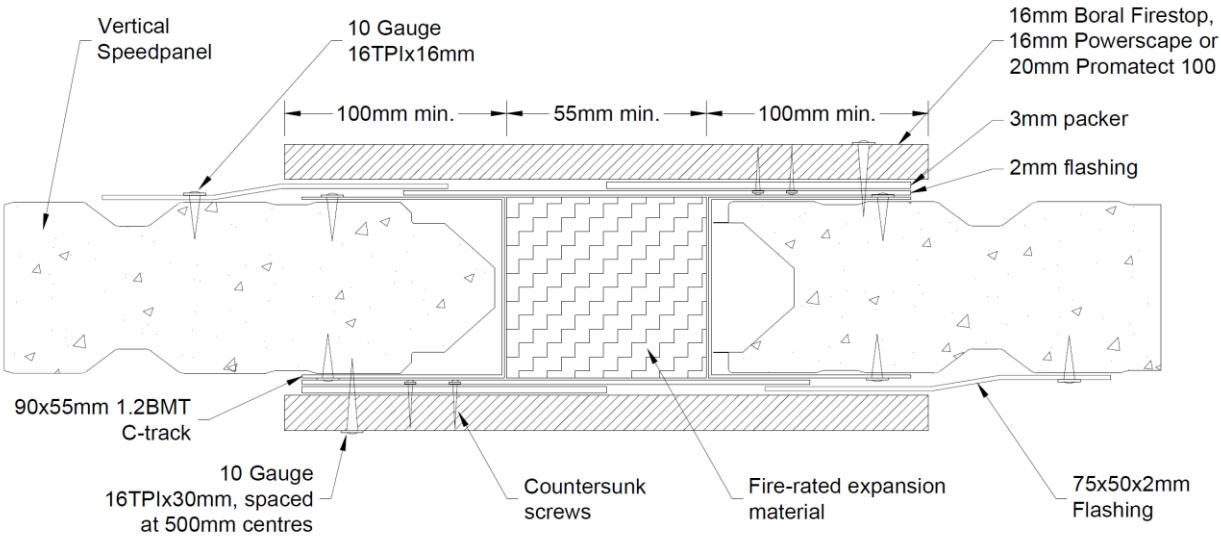

Figure 1 –Expansion Joint Cover System Both Sides

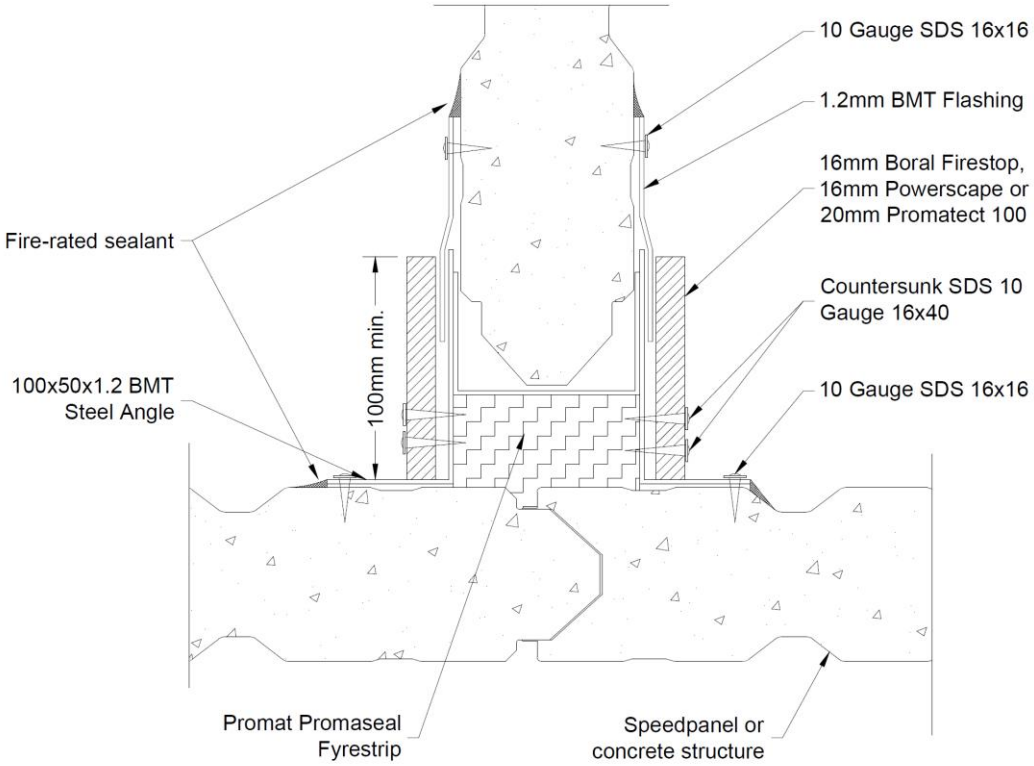

Figure 2 –Expansion Joint Cover System Abutment Detail

4. Referenced test standard

The referenced assessment report is prepared with reference to the requirements of AS1530.4-2014 and AS4072.1-2005 for the determination of a FRL

5. Formal assessment summary

On the basis of the discussion presented in this report, it is the opinion of this testing authority that if the tested prototypes described in Section 2 had been varied as in Section 3, they would have been likely to achieve the fire resistance performances below if tested in accordance with the test method referenced in Section 4 and subject to the requirements of Section 7.

FRL: -/120/120

6. Direct field of application

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

7. Requirements

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 and floor construction shall be capable of providing effective support of the proposed construction for the required fire resistance period (FRL).

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.

8. Validity

This assessment report does not provide an endorsement by Warringtonfire Aus Pty Ltd of the actual products supplied.

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.

Because of 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.

The assessment can therefore only relate only to the actual prototype test specimens, testing conditions, and methodology described in the supporting data, and does not imply any performance abilities of constructions 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 be reviewed on or, before, the stated expiry date.

The information contained in this 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.

9. Authority

9.1 Applicant undertakings and conditions of use

By using this report as evidence of compliance or performance, the applicant(s) confirms 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, and
- They agree to withdraw this assessment from circulation should the component or element of structure be 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, and
- 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, agree to ask the assessing authority to withdraw the assessment.

9.2 General conditions of use

This report may only be reproduced in full without modifications by the report sponsor. Copies, extracts or abridgments of this report in any form shall not be published by other organisations or individuals without the permission of Warringtonfire Aus Pty Ltd.

Appendix A Summary of supporting data

A.1 Test report – FT10-95

A.1.1 Report sponsor

Fyreguard Pty. Ltd., 10-12 Rosslyn Street, Mile End, SA, 5031

A.1.2 Test Laboratory

Gyprock Bradford Research Centre, 376 Victoria Street, Wetherill Park, NSW 2164.

A.1.3 Test Date

The test was conducted on 13 October 1995.

A.1.4 Test standards prescribed

The test was conducted using the heating conditions and performance criteria described in AS1530.4-1990.

A.1.5 Variations to Test Standard

None.

A.1.6 General description of tested specimens

The specimen comprised of 900 × 900mm plasterboard drywall system, using 64CS55 steel studs protected by 2×16 Gyprock Fyrchek, screw fixed in accordance with the manufacturers specifications. A 55mm wide expansion gap was formed centrally by placing the central studs 87mm apart and lining this with a single layer of 16mm Gyprock Fyrchek. Incorporated into the expansion joint was a Fyreguard FS 76 FYRESTRIP, stated by the manufacturer to be identical to Promat PROMASEAL® FyreStrip.

A.1.7 Instrumentation

The instrumentation was provided and applied in accordance with AS1530.4-1990.

A.1.8 Test Results

The test was terminated after 141 minutes.

The temperature at the start of the test was 23°C.

Pressure was maintained in accordance with AS1530.4-1990 and AS4072.1-1992.

Criteria	Performance
Structural Adequacy	not applicable
Integrity	No failure at 141 minutes
Insulation	123 minutes, thermocouple on surface of seal exceeded the 180K rise limit Maximum temperature rise at 120 minutes was 173K

A.2 Relevance of AS1530.4-1990 Test Data With Respect to AS1530.4-2014

A.2.1 General

The referenced fire resistance test FT10-95 was conducted in accordance with AS 1530.4-1990, which differs to AS 1530.4-2014. The aspects of the test method considered capable of altering the recorded specimen performance are discussed below.

A.2.2 Furnace Temperature Measurement

The furnace thermocouple specification in AS1530.4-1990 is not considered to be appreciably different to that in AS1530.4-2014.

A.2.3 Furnace Temperature Regime

AS1530.4-2014 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4-2014} = 345 \log_{10}(8t+1) + 20$$

AS1530.4-1990 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4-1990} = 345 \log_{10}(8t+1) + T0,\ 10°C < T0 < 40°C$$

Test report FT10-95 states that that the temperature at the commencement of the test (T0) was 23°C. The temperature regimes thus differ by only 3°C, which is within the limits prescribed in AS1530.4-2014.

The parameters outlining the accuracy of control of the furnace temperature in AS1530.4-2014 and AS1530.4-1990 are not appreciably different.

A.2.4 Furnace Pressure Regime

AS 1530.4-1990 does not nominate a minimum pressure differential for either vertical or horizontal specimens. However AS4072.1-1992 clause 3.1.4 states the pressure at the lowest point of a penetration, shall be 8Pa. As the specimen is tested in accordance with AS4072.1-1992 it was considered reasonable to accept the furnace pressure was at least 8Pa at the base of the seal.

AS 1530.4-2014 section 10 requires the furnace to be operated such that a minimum pressure of 10Pa is established at the base of the seal and a minimum of 12Pa is at the centre of the seal.

A.2.5 Specimen Temperature Measurement

The specimen thermocouple specification in AS1530.4-1990 and AS1530.4-2005 is considered to be approximately equivalent.

AS1530.4-2014 specifies thermocouple locations for linear gap seals (control joints), as follows:

- 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.

In FT10-95, thermocouples were located as follows:

- Two thermocouples in the centre of the seal, located 230mm and 690mm respectively from the top of the wall.
- Four thermocouples on the separating elements, located 25mm from the edge of the seal.

By observation of the above, the tested specimen was not instrumented in strict accordance with AS1530.4-2014. Specifically, at least three thermocouples should have been located on the seal, rather than the two applied.

A.2.6 Specimen Size

It is the requirement of AS1530.4-2014 that a control joint specimen be at least 1m long, this requirement has not been met by the specimen tested in FT10-95, where the control joint was 900mm long. The influence this has on the results is considered on a case by case basis in Appendix B.

A.2.7 Structural Adequacy Performance Criteria

Not applicable.

A.2.8 Integrity Performance Criteria

Failure in relation to integrity shall be deemed to have occurred if the specimen:

- Collapses,
- Sustained flaming on the non-fire side in excess of 10 seconds,
- Ignition of cotton pad within 30 seconds when applied.

The specimen shall be deemed to have failed the integrity criterion in accordance with AS1530.4-1990 if it collapses, or develops cracks, fissures or other openings through which flames or hot gases can pass.

A.2.9 Insulation Performance Criteria

Apart from the difference in specimen thermocouple locations previously discussed, the failure criteria for insulation in AS1530.4-2014 and AS1530.4-1990 are the same.

A.2.10 Application of AS1530.4-1990 Test Data to AS1530.4-2014

The likely effects of the location and number of thermocouples, length of the linear gap seals and 2Pa difference in the furnace pressure effects is discussed on a case by case basis in Appendix B.

In absence of further significant variations in testing procedure, it is considered that the results relating to the integrity and insulation performance of the tested penetrations in FT10-95 can be used to assess FRL's in accordance with AS1530.4-2014 and AS4072.1-2005, as discussed in Appendix B.

A.3 Test Report – EWFA 2517300.2

A.3.1 Report Sponsor

Speedpanel (VIC) Pty Ltd, 89-91 Canterbury Road, Kilsyth, VIC, 3137.

A.3.2 Test Laboratory

Warringtonfire Aus Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, VIC, 3175.

A.3.3 Test Date

The fire resistance test was conducted on 27th October, 2010.

A.3.4 Test Standard

The test was conducted in accordance with AS1530.4-2005.

A.3.5 Variations to Test Method

The dampers were not tested in full accordance with AS1530.4-2005, as the required leakage test was not conducted on the dampers.

The cable system included cables which protruded 75mm (less than the required 200mm minimum) beyond the extents of the penetration sealing system.

A.3.6 General Description of Tested Specimen

The supporting construction comprised 77mm thick Speedpanel panels vertically oriented to form a vertical wall system.

Several penetrations were included within the wall system. Only the performance of Speedpanel wall is relevant to this assessment:

A.3.7 Instrumentation

The instrumentation was provided and applied in accordance with AS1530.4-2005.

A.3.8 Test Results

The test duration was 195 minutes.

The wall specimens achieved the following performance when evaluated against the failure criteria of AS1530.4-2005:

Specimen	Integrity	Insulation
Wall	Failure at 145 minutes due to flaming for more than 10 seconds	Failure at 20 minutes due to 180°C rise in temperature on east vertical track

A.4 Relevance of AS1530.4-2005 test data with respect to AS1530.4-2014

A.4.1 General

The fire resistance tests EWFA 2517300.2 was conducted in accordance with AS1530.4-2005, which is differs from AS1530.4-2014. The effect these differences have on fire resistance performance of the referenced test specimens is discussed below.

A.4.2 Discussion

Temperature

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

$$Tt-T0 = 345\log(8t+1) + 20$$

Where;

T_t = furnace temperature at time t, in degrees Celsius

T_o = initial furnace temperature, in degrees Celsius, such that

T = the time into the test, measured in minutes from the ignition of the furnace

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

Furnace Pressure

The furnace pressure conditions for single and multiple penetration sealing systems in AS1530.4-2005 and AS1530.4-2014m are not appreciably different,

The parameters outlining the accuracy of control of the furnace pressure in AS1530.4-2014 and AS1530.4-2005 are not appreciably different.

Performance Criteria

AS1530.4-2014 specifies the following performance criteria for building materials and structures:

- Structural Adequacy (not relevant)
- Integrity
- Insulation.

Integrity

AS1530.4-2014 stipulates in addition to the 20mm thick x 100mm x 100mm cotton pads additional cotton pads shall be provided with a reduced 30mm x 30mm x 20mm with additional wire frame holder shall be used to determine integrity failure.

Apart from the above variation, the failure criteria for integrity in AS1530.4-2014 and AS1530.4-2005 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.

A.4.3 Application of Test Data to AS1530.4-2014

There is a difference in cotton pad size between standards, however it is confirmed that the variation does not affect the integrity performance of the tested penetrations in the referenced tests for at least 120 minutes.

Based on the above, discussion and in absence of any foreseeable integrity and insulation risk, it is considered that the results relating to the integrity and insulation performance of the specimens tested in EWFA 2517300.2 can be used to assess the integrity and insulation performance in accordance with AS1530.4-2014.

Appendix B Assessment of specific variations

B.1 Performance of Control Joint in Accordance with AS1530.4-2014 and AS4072.1:2005

B.1.1 Proposal

It is proposed that the test data in FT10-95 be used to support the likely fire resistance of the tested specimen in accordance with AS1530.4-2014 and AS4072.1:2005

B.1.2 Discussion

As discussed in Appendix A, several aspects of the FT10-95 test represent incompliances with respect to AS1530.4-2014. Specifically, the specimen thermocouple locations, specimen length and furnace pressure utilised in the test were not in accordance with AS1530.4-2014. The effect of each will be discussed separately, and then cumulative effects will be considered.

Specimen Thermocouple Locations

As was noted earlier, the incompliance lies in the number of thermocouples distributed along the control joint itself- two were applied in the test, and at least three are required by AS1530.4-2014.

The issue lies in that typically, due to furnace pressure differentials and convective non-fire side effects, the upper sections of a given specimen will tend to be measured to be at higher temperatures than lower sections. It is noted that at later stages of the test, due to the presence of thermocouple insulating pads, the non-fire side convection mode is weak.

This effect was observed in the FT10-95 test- of the two thermocouples located on the seal, the lower one (located 210mm from floor level) was on average approximately 25K cooler than the higher one (located 670mm from floor level). At 120 minutes, the lower was 35K cooler than the higher.

Evenly distributing three thermocouples along the length of the proposed control joint will result in a thermocouple located higher than those utilised in the FT10-95 test.

In light of the above, it is considered that if the specimen tested in FT10-95 was instrumented in accordance with AS1530.4-2014, it would have likely registered a slightly higher maximum temperature. That is, the insulation performance would likely be slightly reduced.

Control Joint Length

The control joint tested in FT10-95 was 900mm in length, whereas AS1530.4-2014 requires a minimum of 1000mm.

In general, control joints are prone to shrinkage at high temperatures. The tendency to shrink induces stress in the seal material and can cause cracking- integrity weakness. Under certain conditions, longer control joints may endure increased shrinkage stress compared to shorter ones.

It is noted that these shrinkage effects are somewhat negated if the seal material is intumescent, which expands and tends to fill any gaps formed by shrinkage effects. This appears to have been the case in FT10-95, as no fissuring was observed for the test duration of 141 minutes.

In light of the above, it is considered that if the specimen tested in FT10-95 was increased to 1000mm in length, the integrity-related behaviour would not be significantly affected.

Furnace Pressure

AS1530.4-2014 requires that the neutral pressure axis be established 500mm from the notional floor level. There is no equivalent pressure requirement in AS1530.4-1990, and the test pressure was not reported in FT10-95.

Since the test pressure is not known, it must be assumed that it could have been lower than that prescribed in AS1530.4-2014. Low pressure is less onerous in regard to specimen integrity; however this is only true after through gaps form in the specimen, thus allowing venting.

No gaps were noted to form in the 141 minute-long test. In light of this, and considering the intumescent nature of the seal material, it is considered that a higher pressure, as required by AS1530.4-2014, would have significantly reduced the integrity performance of the tested seal.

As stated previously, furnace pressure and its differential can contribute to the phenomenon whereby thermocouples placed higher on the specimen measure higher temperatures. Thus, if the tested pressure were significantly lower than that required by AS1530.4-2014, the test would have been less onerous in regard to insulation performance than required.

Cumulative Effects and Conclusion

The increased temperature measurements likely produced by the addition of a third thermocouple would be worsened by an increase in length of the joint, since the additional thermocouple would be located farther from the floor level than those in the test.

If the joint length was increased to 1000mm and three thermocouples were distributed evenly along the length, it is calculated that one would be located 750mm from the base of the joint, 80mm higher than the highest tested thermocouple.

The maximum temperature rise of the seal tested in FT10-95 was reported to be approximately 173K at 120 minutes. Accordingly, the specimen exceeded the insulation criteria at 123 minutes. The maximum temperature rise recorded at 90 minutes was approximately 120K.

Since the pressure in the test was not reported, it is not possible to formulate an expression for the measured non-fire side temperature increase expected when the pressure and height of the specimen is increased, for the starting point is not known.

It is considered that the approximate 7K margin at 120 minutes may be reduced to zero by the variations in specimen length and thermocouple placement required by AS1530.4-2014. However, the approximate 60K margin at 90 minutes is not considered likely to be reduced to zero by the variations.

The tested specimen maintained integrity for the 141 minute test and as stated in the previous section, the length and pressure incompliances are not likely to significantly reduce the integrity performance due to the intumescent nature of the seal.

In light of the above, it is considered that if the control joint specimen tested in FT10-95 were tested in accordance with AS1530.4-2014, it would likely maintain integrity and insulation for 120 and 90 minutes respectively.

B.2 PROMASEAL® FyreStrip fitted to Speedpanel Walls

B.2.1 Proposal

It is proposed that the tested 128mm thick CSR Fyrchek lining stud wall tested in FT10-95 be replaced with 77mm thick vertically oriented Speedpanel wall as shown in Figure 1 and 2.

B.2.2 Discussion

For the type of construction proposed, the salient issues are heat transfer from the wall to the control joint material, the support provided by the PROMASEAL® FyreStrip channel and PROMASEAL® FyreStrip cover strip interface and the transfer of heat through the cover strip to the PROMASEAL® FyreStrip and through wall panels to PROMASEAL® FyreStrip.

Integrity and Insulation of the PROMASEAL® FyreStrip with Cover Strip

When tested in FT10-96 plasterboard wall was 128mm thick, and the PROMASEAL® FyreStrip was 76mm deep and located at the centre of the aperture. The proposed construction is 78mm thick and comprises the joint fitted centrally and protected on both sides with 1.2mm lapped steel facing covered with a board material made from 16mm Boral Firestop™ or 16mm Powerscape or 20mm Promatect 100. The total thickness of the control joint including the PROMASEAL® FyreStrip and cover strips is nominal 117mm at wall joint and 114mm at wall abutment.

By inspection of figure 1, the proposed construction introduces a number of features that decrease the fire exposure to the joint on the fore side and increase the insulation performance of the joint on the non-fire side

The proposed board and underlying steel sheet will work together to provide a barrier to heating via the insulation performance of the board until it falls away and the integrity performance of the underlying mechanically fixed steel sheet will maintain a radiant barrier for the duration of the test.

On the non-fire side the proposed board and underlying steel sheet will work together to provide a barrier to heating via the insulation performance of the board improving the insulation performance on the non-fire side for the duration of the test.

If the specimen tested in FT10-95 was tested in accordance with AS1530.4-2005 it would likely exceed insulation at or just before 120 minutes. In light of the above discussion it is considered the additional protection afforded by the cover strips would improve the insulation performance to 120 minutes with some margin.

The insulation and integrity performance of the speed panel

With reference to EWFA 2517300.2 in which the specimen comprised 78mm thick × 290mm wide × 3000mm high panels vertical oriented and with 78mm x 53mm x 1.2mm steel tracks at the vertical edges.

At the edges panel abutted a ceramic fibre gasket at the edge of the wall. At this location wall maintained integrity for 145 minutes and the insulation performance and insulation performance 20 minutes on the track and 30 minutes. It was observed during the test that hot gases were leaking through the joint between the track and the ceramic fibre gasket and heating the track on the non-fire side of the specimen. Thermocouples 80mm from the track edge for a cut panel were 282oC whereas where the panel was a not cut the temperature was 114°C at 120 minutes.

The proposed construction incorporates uncut panel edges and an intumescent seal product, that when tested, did not exhibit significant gaps or allow the leakage of hot gasses. It is also expected to expand against the side of the track and seal for at least 120 minutes.

The proposed cover strips extend a minimum of 100mm from the track edge and therefore are expected to ensure that the insulation performance on the panel adjacent the control joint will undergo a rise of less than 180°C up to 120 minutes.

From the above discussion it can be deduced that cover strips on the non-fire side will likely be at considerably lower temperatures compared with the seal material due to thermal separation. The presence of the fire side cover strip will also shield the area from exposure, further increasing insulation performance. Due to the low conductivity of intumescent material, it is not considered likely that appreciably more heat would transfer through the intumescent strip and into the cavity and non-fire side, compared with the transfer directly from fire to non-fire side.

In light of the above, it is considered that the proposed detail would not likely present a more onerous condition to the tested control joint when tested in a plasterboard lined wall in FT10- 95.

In light of the above discussion, it is considered that the proposed control joint will achieve a fire resistance of 120 minutes integrity and insulation if tested in accordance with AS 1530.4- 2014.

B.3 Wall Abutment Control Joint

B.3.1 Proposal

It is proposed that above discussed joint detail be applied to T-junction with Speedpanel/masonry/concrete wall as shown in figure 2.

B.3.2 Discussion

With reference to the sections B2 of this report the discussion of the integrity and insulation of the seal and panel arrangement is considered positively assessed for a period 120 minutes.

The effect of the adjacent panel will affect the performance of the joint. It is expected that the wall will contribute to the lowering of the seal temperature by leeching some heat from it.

For the purpose for this assessment a conservative approach has been taken and the cover strip protection has been extended at least 100mm from the T-junction to fully or partially cover the exposed steel flashing.

A conservative approach is taken and it is considered that FyreStrip joint with cover strips on both sides will at least keep a temperature differential of 100°C and keep the unexposed side below 200°C at 120 minutes.

In light of the above discussion, it is considered that the proposed control joint will achieve a fire resistance of 120 minutes integrity and insulation if tested in accordance with AS 1530.4- 2014.