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# FIRE ASSESSMENT REPORT

# FAR 4002

## FIRE RESISTANCE OF EMSEAL EXPANSION JOINT SYSTEMS TO AS 1530.4-2005

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# ASSESSMENT OBJECTIVE

This report gives BRANZ assessment of the fire resistance of the EMSEAL corp control joints if they were tested in accordance with AS 1530.4-2005.

# LIMITATION

This report is subject to the accuracy and completeness of the information supplied.

BRANZ reserves the right to amend or withdraw this assessment if information becomes available which indicates the stated fire performance may not be achieved.

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# TERMS AND CONDITIONS

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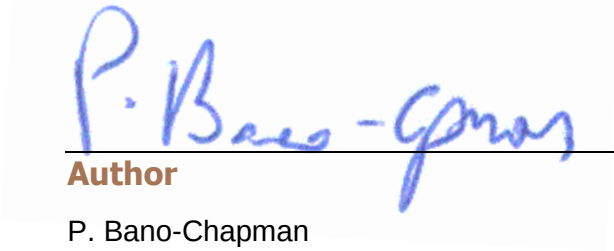
# SIGNATORIES



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# DOCUMENT REVISION STATUS

| ISSUE NO. | DATE ISSUED | DESCRIPTION |
|---|---|---|
| 1 | 7 May 2013 | Initial Issue |

# 1. INTRODUCTION

This report gives BRANZ assessment of the fire resistance of the EMSEAL corp control joints if they had been tested in accordance with AS 1530.4-2005.

# 2. BACKGROUND

## 2.1 Floor control joint data

In Underwriters Laboratories fire resistance test report File R26111, Project 08CA51790 dated 2009-03-06 a control joint was tested in accordance with UL 2079 – October 21, 2004. The test specimen consisted of compressed fire retardant impregnated foam with a layer of silicone above and intumescent to the underside. The specimen was made up in two parts with a butt joint. The joint was installed in accordance to the manufactures instructions. On the exposed face one half was exposed intumescent and the other half the intumescent layer was covered with a further silicon layer. The overall length of the control joint was 1,600 mm long.

The control joint was a nominal 100 mm wide but can have up to +/- 25 mm movement. The seal was tested in 125 mm wide gap between 114 mm thick concrete slabs and secured with epoxy. The control joint was tested without failure of Integrity or Insulation for the 120 minute duration of the test.

In Underwriters Laboratories fire resistance test report File R26111, Project 10CA33451 dated 2010-09-22 a control joint was tested in accordance with UL 2079 – October 21, 2004. The test specimen consisted of compressed fire retardant impregnated foam with a layer of silicone above with intumescent and silicone to the underside. A continuous 150 mm deep spine was positioned mid width of the centreline of the control joint. The top 50 mm of the spine was an extruded aluminium section and the remainder made from polycarbonate plastic. The control joint was covered with an aluminium cover plate which overlapped the edge of the concrete by at least 63 mm and was screw fixed to the central spine. The specimen was made up in three parts with the joints installed in accordance to the manufactures instructions with an overall length of 3,660 mm long.

The control joint was a nominal 250 mm wide but can vary between 125 mm up to 375 mm wide. The seal was tested in 375 mm wide gap between 152 mm thick concrete slabs and secured with epoxy. The control joint was tested without failure of Integrity or Insulation for the 133 minute duration of the test.

## 2.2 Wall control joint data

In Underwriters Laboratories fire resistance test report File R26111, Project 09CA09051 dated 2009-05-28 a control joint was tested in accordance with UL 2079 – October 21, 2004. The test specimen consisted of compressed fire retardant impregnated foam with a layer of silicone and intumescent to each face. The

specimen was made up in two parts with the joint installed in accordance to the manufactures instructions and an overall length of 1,900 mm long.

The control joint was nominally 150 mm wide but can vary between 114 mm up to 190 mm wide. The seal was tested in 190 mm wide gap between 200 mm thick masonry wall and secured with epoxy. After 22 minutes into the test the furnace was shut off and restarted at 32 minutes. The test then ran on for 130 minutes without failure of Integrity or Insulation. A further fire test was conducted for 60 minute followed by a hose stream without Integrity failure of the control joint.

# 3. DISCUSSION

## 3.1 UL 2079 vs AS 1530.4-2005

The significant differences between UL 2079 and AS 1530.4:2005 are in the time temperature curve, furnace pressure, furnace thermocouple construction, unexposed face thermocouple pad specification and number of thermocouples on the unexposed face.

The two standards follow different time temperature curves which differ in their severity over time. The UL curve has a more rapid rise at the start of the test then falls below the AS 1530.4:2005 curve after approximately 50 minutes. Based on the area under the curve, for each time temperature regime the UL curve starts off having a higher temperature then after approximately 50 minutes the UL curve starts to fall below the AS 1530.4:2005 curve. At 120 minutes the AS 1530.4:2005 curve is approximately 1.7% more severe based on the area under curve than the UL curve.

Inspection of the UL test data indicates that the furnace complied with the standard for the 120 minute duration of the test. An examination of the furnace temperature graph in the UL test data and the comparison of the furnace curves suggest that the furnace conditions would have at least also complied with AS 1530.4:2005 for the 120 minutes test duration.

### 3.1.1 Furnace thermocouples

A difference between test standards is the furnace thermocouples used. UL 2079 define either thermocouples protected by a porcelain tube or a wrought-steel/iron tube whereas AS 1530.4:2005 uses 3 mm mineral insulated metal sheathed thermocouples. The difference between thermocouples means the UL 2079 thermocouples are less responsive to rapid temperature rise than those defined in AS 1530.4:2005. This is due to having a larger thermal mass to heat up, which in turn means the furnace conditions at the start of the UL test are in fact more severe than indicated by the compassion between curves, as more heat is required to achieve the same temperature rise when compared to the furnace thermocouples used in AS 1530.4:2005.

After approximately 40 minutes the temperature rise defined in the curves is reduced and the temperature indicated by the different thermocouples are likely to be more consistent. This difference in thermocouples indicates the severity of exposure on the test specimen is likely to be closer to the AS 1530.4:2005 curve at 120 minutes than a comparison between curves indicates. Therefore it is further considered the furnace temperature gives similar heating conditions to those in AS 1530.4:2005 for at least 120 minutes.

### 3.1.2 Furnace pressure

The pressure conditions of UL 2079 define a pressure of 2.5 Pa ±20% (±0.5 Pa), 20 mm below the lowest penetration whereas AS 1530.4:2005 defines the pressure as 15 Pa ±3 Pa at the centre of the lowest specimen. In this case AS 1530.4:2005 is a more severe exposure condition as furnace gases will be pushed through any holes in the test specimen and potentially causing ignition of a cotton pad should any through gaps appear and also flaming on the unexposed face. There were no gaps recorded in the test record, however the greater positive pressure on the specimen in a test to AS 1530.4:2005 could also cause greater erosion of the specimen on the exposed face causing gaps to appear and hence possible Integrity failure. Based on the observations in the test reports and the fact that the control joints were subjected to an additional hose stream it is considered that the specimens would achieve Integrity of at least 120 minutes.

### 3.1.3 Unexposed face thermocouples

In UL 2079 the unexposed face thermocouple pads are 50 mm x 50 mm x 10 mm and in AS 1530.4:2005 they are 30 mm x 30 mm x 2 mm, of a similar insulating material. The UL 2079 thermocouple pad would therefore tend to insulate the surface more because of their size and would be expected to give a higher temperature than in AS 1530.4:2005.

In UL 2079 there may only be one thermocouple where AS 1530.4:2005 specifies two thermocouples. The single thermocouples are in the same distance within the plane of the specimen and along the penetration and along any cables as specified in AS 1530.4:2005. Taking into consideration the discussion above on thermocouple pads it is considered that one thermocouple would be sufficient to determine the insulation, hence the result of the UL 2079 test is applicable to an assessment to AS 1530.4:2005.

## 3.2 Floor control joint

The two floor control joints tested consist of compressed fire impregnated foam with a silicon coating to both faces and an intumescent coating to the underside.

The control joint tested in UL Project 08CA51790 was nominally 100 mm wide but tested at maximum extension in practice of 125 mm wide. There were no Integrity or

Insulation failures associated with the control joint for the 120 minute duration of the test.

The control joint tested in UL Project 10CA33451 was nominally 250 mm wide but tested at maximum extension in practice of 375 mm wide. The control joint included a central spine and aluminium cover plate. There were no Integrity or Insulation failures associated with the control joint for the 133 minute duration of the test.

As stated in section 3.1 AS 1530.4 requires a furnace pressure of 20 Pa below the floor slab. The furnace pressure in UL Project 08CA51790 was approximately 5 Pa to the underside of the floor. This is less than that specified in AS 1530.4. There were no significant observations noted except for smoking during the first 5 minutes of the test. The temperatures measured on the unexposed face at the end of the test was a maximum of 98°C temperature rise.

Control joints can be susceptible to erosion during fire exposure where furnace gases can migrate through the test specimen. The control joint tested in UL project 08CA51790 was tested at a lower pressure than specified in AS 1530.4 however from the test observations no smoke was noted to be emitted from the specimen after 5 minutes. Further to this the temperatures measured on the unexposed face of the specimen was a maximum of 98°C rise at the end of the test. Based on this information it is considered that the difference in furnace pressure would not prejudice the Integrity and Insulation criteria results of the specimen if it had been tested in accordance with AS 1530.4-2005 for at least 120 minutes.

In UL Project 10CA33451 the 375 mm wide control joint with an aluminium cover was tested at approximately 14 Pa below the floor slab. This is slightly less than that specified in AS 1530.4-2005 however the temperatures measured on the unexposed face at the end of the test at 133 minutes were a maximum of 113°C rise. Based on the measured temperatures and the fact that the specimen exposure was longer than required it is considered that the control joint would achieve at least 120 minutes Integrity and Insulation if it was tested in accordance with AS 1530.4-2005.

The client has stated that the specimen tested in 08CA51790 is referred to as DFR2 and tested in 10CA33451 as SJS-FR2.

## 3.3 Wall control joint

In UL Project 09CA09051 a control joint 190 mm wide x 1,900 mm long was tested in a masonry wall. The specimen was 1,900 mm long and the furnace pressure measured at the top of the furnace was approximately 15 Pa. AS 1530.4-2005 specifies that the pressure for a control joint is set to 15 Pa at might height of the 1,000 mm long specimen. The tested control joint was tested at an approximate 4 Pa lower furnace pressure at the top of the specimen than that required by AS 1530.4-2005.

After 22 minutes into the test the furnace was shut off and restarted at 32 minutes due to a malfunction. The test then ran on for 130 minutes without failure of Integrity or Insulation of the test specimen. The maximum temperature measured at the end of the test was 90°C rise. It is considered that in this case the furnace pressure is sufficiently similar to AS 1530.4 and the temperatures measured at the end of the test are sufficiently below the failure criteria that the tested specimen would achieve at least 120 minutes Integrity and Insulation.

The client has stated that the specimen tested in 09CA09051 is referred to as WFR2 (concrete).

## 3.4 Control joint configuration

The floor control joint tested in UL Project 08CA51790 was nominally 100 mm wide with an expansion maximum allowance of up to 125 mm wide (tested). It is considered that the nominal 100 mm control joint can be installed into gaps between concrete slabs up to a maximum width of 125 mm (including slab shrinkage, expansion/contraction).

The floor control joint tested in UL Project 10CA33451 was nominally 250 mm wide with an expansion maximum allowance of up to 375 mm wide (tested). It is considered that the nominal 250 mm control joint can be installed into gaps between concrete slabs up to a maximum width of 375 mm (including slab shrinkage, expansion/contraction).

The wall control joint tested in UL Project 09CA09051 was nominally 150 mm wide with an expansion maximum allowance of up to 190 mm wide (tested). It is considered that the nominal 150 mm control joint can be installed into gaps between masonry walls up to a maximum width of 190 mm (including slab shrinkage, expansion/contraction).

All control joints must be installed as tested.

# 4. CONCLUSION

It is considered that the EMSEAL control joints tested in UL projects 08CA51790 (product DFR2), 10CA33451 (product WFR2 concrete) and 09CA09051 (product SJS-FR2) would achieve an Integrity and Insulation of at least 120 minutes if tested in accordance with AS 1530.4-2005