



ASSESSMENT REPORT

An assessment of the performance of joiner plates and angle brackets in concrete protected by Unitex panel patch if tested in general accordance with the AS1530.4-2014 and AS4072.1-2005.

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1 INTRODUCTION

This report presents an assessment of the fire resistance performance of steel joiner plates and angle brackets for connecting pre-cast concrete wall panels when protected by Unitex Panel Patch if tested in general accordance with AS1530.4-2014 and AS4072.1-2005.

AS1530.4-2014 does not specifically address the performance of connection details. The general principles of AS1530.4-2014 and AS4072.1-2005 were therefore applied in order to assess the performance of the protection system.

The tested prototypes described in Section 2 of this report, when subject to the proposed variations described in Section 3 and tested in accordance with the referenced test method described in Section 4 are assessed to achieve performance as summarised in Section 5.

The validity of this assessment is conditional on compliance with Sections 6, 7, 8, and 9 of this report.

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

2 TESTED PROTOTYPES

This assessment is based on reference test WFRA 40938, being a test on the performance of joiner plates and angle brackets in concrete protected by Unitex panel patch if tested in general accordance of AS1530.4-1997.

The test was sponsored by Unitex Granular Marble, and was conducted by Warrington fire research consultancy testing.

Refer to APPENDIX A for a summary of the test data.

Unitex Granular Marble, and has confirmed in writing that there have been no changes to the design and material specifications of the Unitex Panel Patch since the referenced test.

3 VARIATION TO THE TESTED PROTOTYPES

The proposed construction shall be as tested in WFRA 40938 without any variation to the tested specimen and shall be as specified in Figures 1 and 2 below:

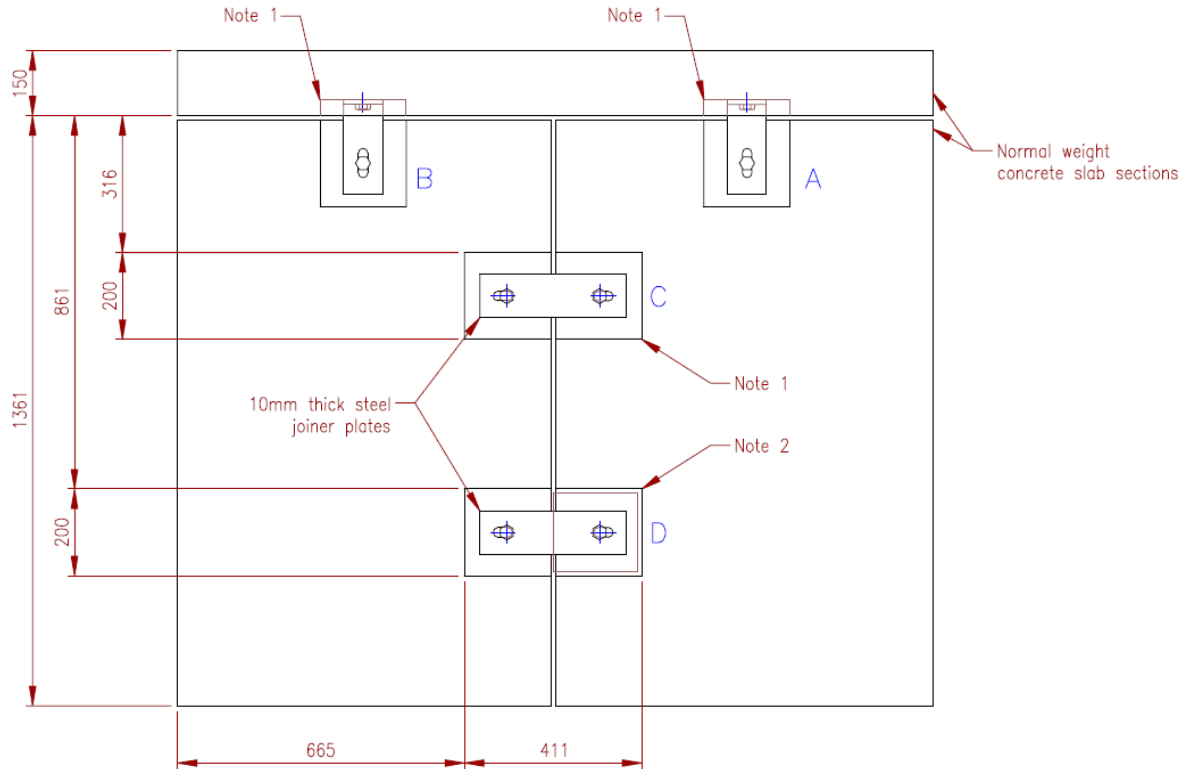


Figure 1: Concrete slab joint construction detail (1) as tested in WFRA 40938.

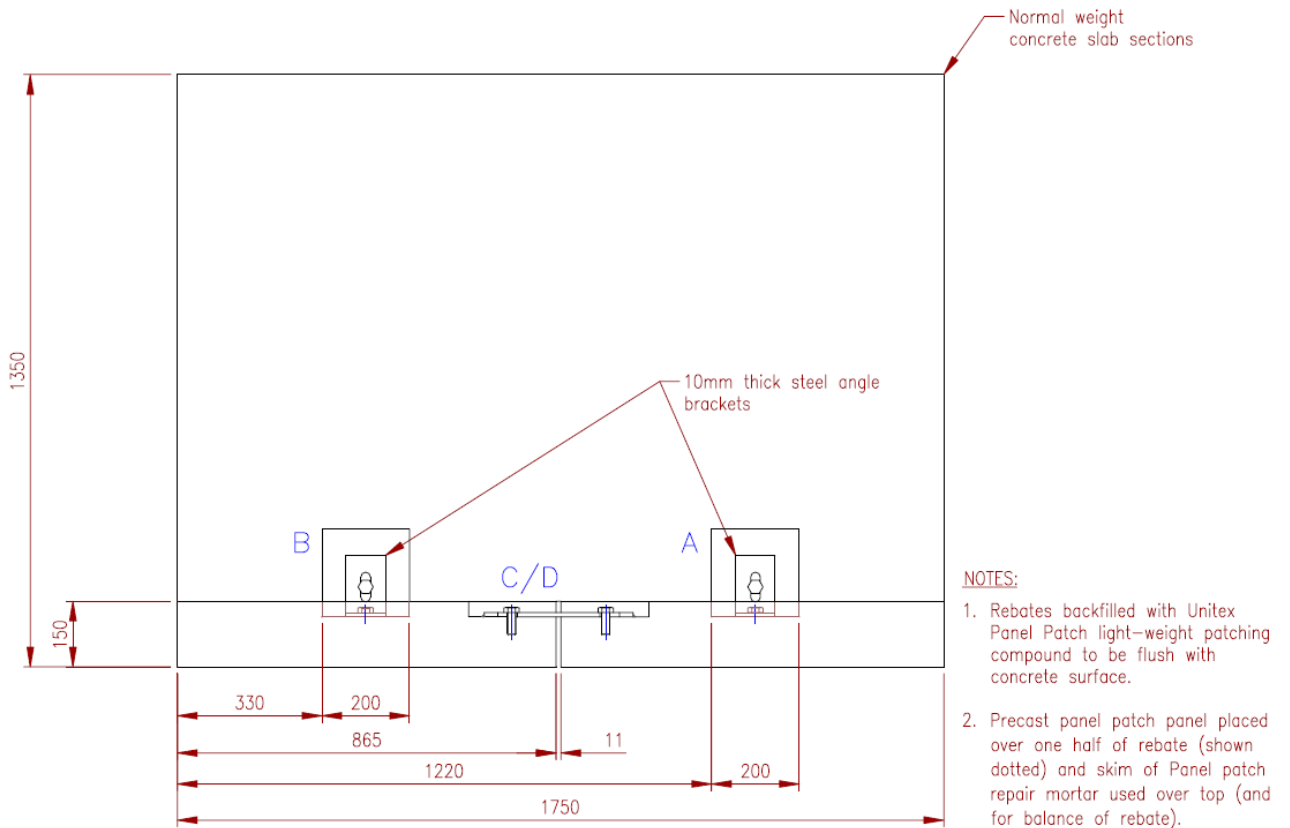


Figure 2: Concrete slab joint construction detail (2) as tested in WFRA 40938.

4 REFERENCED TEST PROCEDURES

This report is prepared with reference to the general requirements of AS1530.4-2014 and AS 4072.1-2005 for penetration and joint sealing systems.

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 prototype described in Section 2 had been varied as in Section 3, it will achieve the fire resistance performance as stated below if tested in accordance with the test method referenced in Section 4 when subject to the requirements of Section 7.

The proposed joint construction is not directly under any nominated section in AS1530.4-2014 and AS4072.1-2005 for methods of fire test on building materials, components and structures. Therefore, an FRL cannot be directly attributed to the system. However, similar "integrity" and "insulation" performances as originally achieved would not be affected for the period of fire resistance of up to 240 minutes.

6 DIRECT FIELD OF APPLICATION

The results of the referenced assessment are applicable to the general principles of the joint and penetration sealing systems.

This report's outcome is necessarily limited to the performance requirement described in section 5 and the system construction in section 3 together with referenced test reports and discussion in the Appendices.

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 general accordance with AS1530.4-2014 and AS4072.1-2005.

It is required that the supporting construction be otherwise tested or assessed to achieve the FRL in section 5.

All services shall be supported in the manner in which they are assessed as described in Appendix A. 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 Exova 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

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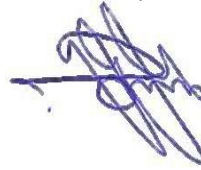
9.3 AUTHORISATION ON BEHALF OF EXOVA WARRINGTON FIRE AUS PTY LTD

Prepared by:

Reviewed by:



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9.4 DATE OF ISSUE

11 November 2018

9.5 EXPIRY DATE

31 November 2023

APPENDIX A SUMMARY OF SUPPORTING DATA

A.1 TEST REPORT – WFRA 40938

A.1.1 Report Sponsor

A.1.1.1 Unitex Granular Marble, 22 Park Drive, Dandenong, Vic 3175

A.1.2 Test Laboratory

A.1.2.1 Warrington fire research consultancy testing.

A.1.3 Test Date

A.1.3.1 The fire resistance test was conducted on 15/11/2002.

A.1.4 Test Standards

A.1.4.1 The test was conducted in general accordance with AS1530.4-1997.

A.1.5 Variations to Test Method

A.1.5.1 None

A.1.6 General Description of Tested Specimen

A.1.6.1 In order to ascertain the ability of the Unitex Panel Patch to remain in place and insulate the steel plate a test assembly was constructed comprising three concrete panels fixed together with two joiner plates and two angle brackets. The angle brackets and joiner plates were fabricated from 10mm thick steel and protected by Unitex Panel Patch of minimum thickness nominally 35mm.

A.1.7 Instrumentation

A.1.7.1 The test report states that the instrumentation was in general accordance with AS1530.4-1997.

A.1.8 Test results

A.1.8.1 The test specimen achieved the following result:

Criteria	FRL
Structural adequacy	NA
Integrity	240 minutes
Insulation	240 minutes

A.2 RELEVANCE OF AS 1530.4–1997 TEST DATA WITH RESPECT TO AS 1530.4–2005

A.2.1 General

A.2.1.1 The referenced fire resistance test WFRA 40938 was conducted in accordance with AS 1530.4–1997, which differs slightly from AS 1530.4–2005. These variations and their potential effect on the fire resistance performance of the test specimen are discussed below.

A.2.2 Temperature Regime

A.2.2.1 The heating regime in fire resistance tests conducted in accordance with AS 1530.4–2005 follows a similar trend to that in AS 1530.4–1997. The specified heating rate in AS 1530.4–1997 is given by:

$$T_t - T_0 = 345 \log_{10} (8t + 1)$$

Where;

- T_t = Furnace temperature at time t, in degrees Celsius.
 T_o = Initial furnace temperature, in degrees Celsius, not less than 10°C nor more than 40°C.
t = Time into the test, measured from the ignition of the furnace, in minutes.

A.2.2.2 The heating regimes in AS 1530.4–1997 and AS 1530.4–2005 vary in that the former is an expression of the temperature rise in the furnace above an initial ambient temperature, and the latter, although similar, assumes that the initial furnace temperature (T_o) is 20°C irrespective of the actual ambient temperature.

A.2.2.3 A test conducted in accordance with AS 1530.4–1997 on a warm day with an ambient temperature above 20°C could therefore be slightly more onerous than in accordance with AS 1530.4–2005.

A.2.2.4 The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4–2005 and AS 1530.4–1997 are not appreciably different.

Furnace Pressure

A.2.2.5 The parameters outlining the furnace pressure control for specimens in AS 1530.4–2005 and AS 1530.4–1997 are not appreciably different.

Performance Criteria

A.2.2.6 AS 1530.4–2005 specifies the following performance criteria for building materials and structures:

- Structural Adequacy
- Integrity
- Insulation

Structural Adequacy

A.2.2.7 This criterion is not relevant in this case as the test specimen was not loaded.

Integrity

A.2.2.8 The specimen shall be deemed to have failed the integrity criterion in accordance with AS 1530.4–2005 if the specimen:

- Collapses
- Sustains flaming on the non-fire side in excess of 10 seconds
- Ignites a cotton pad within 30 seconds when applied.

A.2.2.9 The specimen is deemed to have failed to AS 1530.4 1997 if the specimen:

- Collapses
- Develops cracks, fissures or, other openings through which flames or hot gases can pass
- Sustains flaming on the non-fire side in excess of 10 seconds.

A.2.2.10 Prior to the formation of gaps and fissures, the integrity criterion in accordance with AS 1530.4–1997 is generally more stringent. Integrity failure would normally occur prior to failure in accordance with AS 1530.4–2005.

A.2.2.11 No gaps formed in the exposed face of the specimen therefore the differences in the failure criteria are not relevant in this case.

Insulation

A.2.2.12 The insulation criteria of AS 1530.4–1997 and AS 1530.4–2005 are not appreciably different.

A.2.3 Application of Results of WFRA 40938 to AS1530.4-2005.

A.2.3.1 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.

A.2.3.2 The specimen described in WFRA 40938 was tested to general principles of AS1530.4-1997 to assess the performance of the protection system based on determining a structurally critical temperature in accordance with AS4100-1998.

A.2.3.3 On the basis of the above discussion, it is concluded that the results of the test WFRA 40938 remain valid if tested and assessed in accordance with AS1530.4-2005

A.2.3.4 As AS4100 has not been revised and it is therefore considered that the results of this assessment would not have been appreciably different if they were undertaken in accordance with AS1530.4-2005.

A.3 RELEVANCE OF AS1530.4-2005 TEST DATA WITH RESPECT TO AS1530.4-2014

A.3.1 General

A.3.1.1 The fire resistance tests WFRA 40938 was conducted in accordance with AS1530.4-1997 and assessed to AS1530.4-2005, which differs from AS1530.4-2014. The effect these differences have on fire resistance performance of the referenced test specimens is discussed below.

A.3.2 Discussion

Temperature

A.3.2.1 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.

A.3.2.2 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_0 = initial furnace temperature, in degrees Celsius, such that

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

A.3.2.3 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

A.3.2.4 The furnace pressure conditions for single and multiple penetration sealing systems in AS1530.4-2005 and AS1530.4-2014m are not appreciably different,

A.3.2.5 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

A.3.2.6 AS1530.4-2014 specifies the following performance criteria for building materials and structures:

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

Integrity

A.3.2.7 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.

- A.3.2.8 Apart from the above variation, the failure criteria for integrity in AS1530.4-2014 and AS1530.4-2005 are not appreciably different.

Insulation

- A.3.2.9 The positions of thermocouples and failure criteria for insulation in AS 1530.4-2014 and AS 1530.4-2005 are not appreciably different.

A.3.3 Application of Test Data to AS1530.4-2014

- A.3.3.1 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 240 minutes.

- A.3.3.2 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 WFRA 40938 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 JOINER PLATES AND ANGLE BRACKETS IN CONCRETE ELEMENTS PROTECTED BY UNITEX PANEL PATCH

B.1.1 GENERAL

- B.1.1.1 This assessment report refers to test report WFRA 40938, which was conducted in accordance with AS1530.4-1997. Since the issue of original assessment report Australian Standard AS 1530.4-1997 has been superseded by AS1530.4-2014. Therefore, this assessment has been undertaken in general accordance with the requirements of AS1530.4-2014.
- B.1.1.2 The steel angle brackets and joiner plates act as structural members and therefore it was considered reasonable to adopt a limiting mean steel temperature of 550°C for the angle brackets and joiner plates for general application purposes.
- B.1.1.3 In accordance with AS4100-1998 Steel Structures failure of plates/angles would not occur until the load ratio under fire limit state conditions exceeds 0.52 provided the mean temperature does not exceed 550°C. For normal loading applications a load ratio greater than 0.52 is unlikely to occur.
- B.1.1.4 The steel joiner plates and angle brackets manufactured from 10mm thick steel. The angles and joiner plates are temporarily bolted to steel plates cast into pre-cast normal weight concrete panels and then permanently welded to the lower plate such that the upper surface of the plates is at least 25 mm below the face of the precast panel.
- B.1.1.5 The rebate provided for the plates is greater than the size of the angle brackets and joiner plates such that the rebate depth increases locally to approximately 35 mm around the perimeter of the openings.
- B.1.1.6 The Unitex Panel Patch system is then applied over the plates and finished flush with the surface of the concrete providing minimum cover of 25mm. There is an option for a precast patch to be formed which can then be applied by bonding and sealing in place with the Unitex Panel Patch compound.
- B.1.1.7 In order to ascertain the ability of the Unitex Panel Patch to remain in place and insulate the steel plate a test assembly was constructed comprising three concrete panels fixed together with two joiner plates and two angle brackets as shown in Figures 1 and 2.
- B.1.1.8 Control joints between the panels were sealed with a proprietary fire-resistant mastic to simulate a typical installation.
- B.1.1.9 The specimen was subjected to the heating regime of AS 1530.4. Despite some spalling of the concrete panels the Unitex Panel Patches remained in place throughout the four-hour fire resistance test.
- B.1.1.10 The temperatures measured on each bracket / plate during the test are shown in the below Figures 3 and 4 from test WFRA 40938. Only one thermocouple exceeded 550°C during the 4-hour fire test. The single individual temperature in excess of 550°C was recorded by a thermocouple on the plate protected by the precast patch. However, the average temperature of the plate did not exceed 550°C during the 4-hour test. Therefore, the performance criteria was satisfied for 240 minutes.

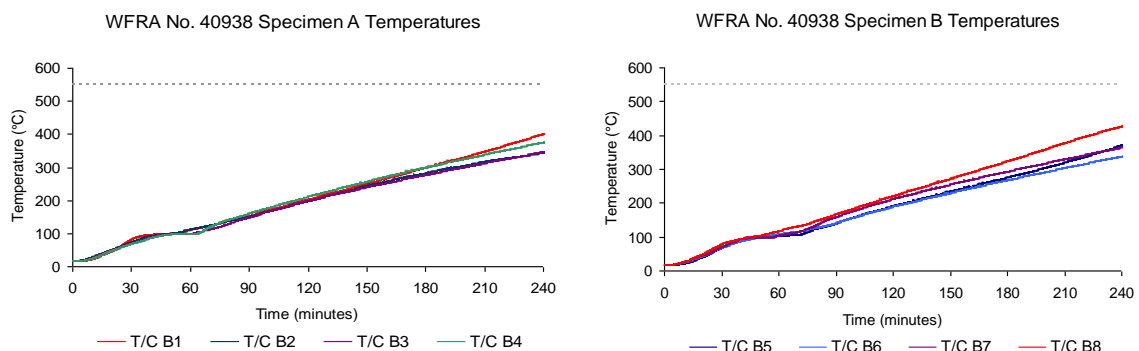


Figure 3: Specimen A and B temperature results as tested in WFRA 40938.

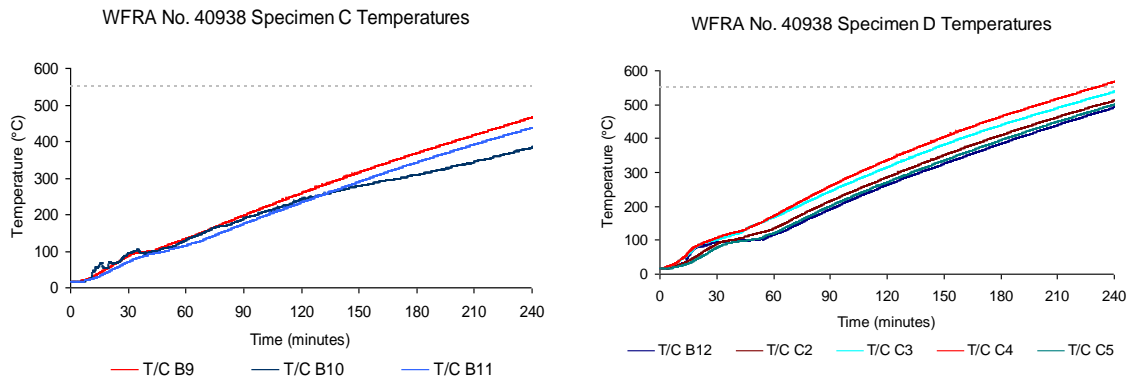


Figure 4: Specimen C and D temperature results as tested in WFRA 40938.

B.1.2 CONCLUSION

- B.1.2.1 On the basis of the above discussion, it is concluded that the Unitex panel patch system providing a minimum of 25mm cover to steel joiner plates or steel angle plates at least 10mm thick as described in this report would achieve a similar “integrity” and “insulation” as the tested systems, and would not be affected for the period of fire resistance of up to 240 minutes when connecting concrete panels having an FRL of at least 240/240/240 and control joints protected to the same fire resistance level.
- B.1.2.2 If the same Unitex Panel Patch System is used with normal weight concrete panels having an FRL of less than 240/240/240 minutes, the fire resistance level of the system will be limited to that of the normal weight concrete panels.
- B.1.2.3 In light of the above, it is considered that the construction tested in WFRA 40938 can be used to assess the performance of Unitex Panel Patch for up to 240 minutes in general accordance with AS1530.4-2014 and AS4072.1-2005.