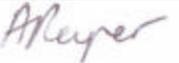


CONFIDENTIAL REPORT

**FIRE RESISTANCE TEST IN GENERAL ACCORDANCE WITH
 AS 1530.4-1997 SECTIONS 2, 3 & 10 AS APPROPRIATE ON A STEEL FRAMED
 PARTITION FACED WITH 2 LAYERS OF 13mm FIRE RATED PLASTERBOARD
 BOTH SIDES INCORPORATING THE STANDARD CONFIGURATION FOR MULTIPLE
 PENETRATIONS, SEALED WITH FIRESOUND ACRYLIC SEALANT.**

Report for

H.B. Fuller
 16-22 Redgum Drive,
 Dandenong South,
 Vic 3175.

Report	Name	Signature/* Authorisation	Date
Prepared by:	C. M. McLean		14. 04. 05
Reviewed by:	K.G. Nicholls		14. 04. 05
Reviewed by:	A. F. Rayner		14. 04. 05

* For and on behalf of Warrington Fire Research Group.

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FIRE RESISTANCE TEST IN GENERAL ACCORDANCE WITH AS 1530.4-1997 SECTIONS 2, 3 & 10 AS APPROPRIATE ON A STEEL FRAMED PARTITION FACED WITH 2 LAYERS OF 13mm FIRE RATED PLASTERBOARD BOTH SIDES INCORPORATING THE STANDARD CONFIGURATION FOR MULTIPLE PENETRATIONS, SEALED WITH FIRESOUND ACRYLIC SEALANT.

Report Sponsor	H.B. Fuller, 16-22 Redgum Drive, Dandenong South, Vic 3175.
Test Laboratory	Warrington Fire Research (Aust) Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong South, VIC 3175.
Test Date	3 rd December 2004.
Test standards prescribed Supplementary Standards	In general accordance with AS 1530.4-1997 Sections 2, 3 and 10, and AS 4072 as appropriate. Nil
Variations from test standard	Average furnace pressure was maintained between 5 Pa and 13 Pa for the duration of the test. This variation is considered not to have adversely affected the results of the test as no gaps or fissures had developed at any of the service penetrations which would allow an increased flow of furnace gases due to a higher pressure level.
General description of tested specimens	The test assembly comprised a 1300mm wide × 1250mm high 64mm steel stud wall faced with 2 layers of 13mm fire rated plasterboard on each side. Within this separating element, the standard configuration for multiple penetrations were installed, designated as Service A to G for the purpose of this report. The penetrations consisted of a 100mm diameter brass pipe (Service A), a 150mm diameter copper pipe (Service B), one bundle of 60 pair 0.5 PVC indoor telephone cables (Service C) and Services D to G comprising 1-off single core PVC insulated, PVC sheathed 630mm ² 127 × 2.52mm conductors, 1-off 3-Core plus earth PVC insulated, PVC sheathed 185mm ² 37 × 2.52mm conductors, 3-off 3-Core plus earth PVC insulated, PVC sheathed 6mm ² 7 × 1.04mm conductors and 8-off 3-Core plus earth PVC insulated, PVC sheathed 16mm ² 7 × 1.7mm conductors. The penetrations were sealed on both sides with FireSound Acrylic Sealant. A more detailed description of the test construction is contained within Appendix 1.
Instrumentation	Instrumentation was provided in accordance with AS 1530.4-1997 and AS 4072 as appropriate. The position of thermocouples are summarised in Table A2.1 and shown on Drawings No. 41118-TS-01 and 41118-TS-02.

Test Procedures	Test procedures were in general accordance with AS 1530.4:1997 as appropriate. Control of the furnace temperature was maintained within the prescribed limits of variance from the time/temperature curve that are specified in Clause 2.9.2 of AS 1530.4:1997 for the duration of the fire resistance test. The furnace pressure was measured level with the centre of the lowest penetration (350mm above the notional floor level) and was maintained between 5 Pa and 13 Pa for the duration of the fire-resistance test.
Test Duration	98 minutes

Service Ref.	Designation	Description
A	100mm brass pipe	Service A comprised one nominal 100mm diameter brass pipe with a wall thickness of 1.3mm extending nominal 500mm into the furnace and nominal 500mm on the non-fire exposed side. The pipe end within the furnace was capped using KAO wool.
B	150mm diameter copper pipe	Service B comprised one nominal 150mm diameter copper pipe with a wall thickness of 1.8mm extending nominal 100mm into the furnace and nominal 500mm on the non exposed side. The pipe end within the furnace was capped using KAO wool.
C	Cable tray supporting telecommunication cables	Service G comprised one bundle of 60 pair 0.5 PVC indoor telephone cables length extending nominal 100mm into the furnace and nominal 500mm to the unexposed side.
D to G	Cable tray supporting electrical cables	Service D comprised 1-off single core PVC insulated, PVC sheathed 630mm ² 127 × 2.52mm conductors. Service E comprised 1-off 3-Core plus earth PVC insulated, PVC sheathed 185mm ² 37 × 2.52mm conductors. Service F comprised 3-off 3-Core plus earth PVC insulated, PVC sheathed 6mm ² 7 × 1.04mm conductors. Service G comprised 8-off 3-Core plus earth PVC insulated, PVC sheathed 16mm ² 7 × 1.7mm conductors.

Table 1 Summary of the Performance of the Test Specimens based on the Criteria Specified in AS 1530.4:1997

Service	Performance Against the Criteria Specified in AS 1530.4:1997	Structural Adequacy	Integrity ¹ (mins)	Insulation (mins)	Fire Resistance Level (FRL)* -/90/30
A	100mm brass pipe	N/A	98	31	-/90/30
B	150mm diameter copper pipe	N/A	98	25	-/90/-
C	Cable tray supporting telecommunication cables	N/A	98	95	-/90/90
D to G	Cable tray supporting electrical cables	N/A	98	96	-/90/90

* Summary of Fire Resistance Levels Ascertained for the Purpose of the Building Code of Australia for the Tested Specimen

¹ Failure due to integrity failure of separating element.

Test Results	
Ambient Air Temperature	Approximately 23°C at the start of the test with no significant variations throughout the test period.
Temperatures Measured vs. Time	Refer to Table A2.1 and Figures A2.1 to A2.5 in Appendix 2.
Observations	Refer to Table A2.2 in Appendix 2.

LIMIT OF APPLICATION

The results only relate to the behaviour of the specimen of the element of the construction under the particular conditions of the test; they are not intended to be the sole criteria for assessing the potential fire performance of the element in use nor do they reflect the actual behaviour in fires.

The results of this fire test apply to the configuration as tested. Any variations to the test configuration may achieve different results. It is therefore recommended that any proposed variation to the tested configuration should be referred to the test sponsor in the first instance to obtain appropriate documentary evidence of compliance from a registered Testing Authority.

WFRA

APPENDIX 1

DESCRIPTION OF THE SPECIMEN

A1.1 GENERAL DESCRIPTION

- A1.1.1 The test assembly comprised a 1300mm wide × 1250mm high 64mm steel stud wall faced with 2 layers of 13mm fire rated plasterboard on each side. Within this separating element, the standard configuration for multiple penetrations were installed, designated as Service A to G for the purpose of this report. The penetrations consisted of a 100mm diameter brass pipe (Service A), a 150mm diameter copper pipe (Service B), one bundle of 60 pair 0.5 PVC indoor telephone cables (Service C) and Services D to G comprising 1-off single core PVC insulated, PVC sheathed 630mm² 127 × 2.52mm conductors, 1-off 3-Core plus earth PVC insulated, PVC sheathed 185mm² 37 × 2.52mm conductors, 3-off 3-Core plus earth PVC insulated, PVC sheathed 6mm² 7 × 1.04mm conductors and 8-off 3-Core plus earth PVC insulated, PVC sheathed 16mm² 7 × 1.7mm conductors. The penetrations were sealed on both sides with FireSound Acrylic Sealant.
- A1.1.2 Details of the test construction are shown schematically on Drawings No. 41118-TS-01 and 41118-TS-02.
- A1.1.3 The materials for the separating element and services for the test specimen were supplied and installed by WFRA staff into the steel test restraint frame and who subsequently attached thermocouples after the specimen construction had been completed. The FireSound Acrylic Sealant was supplied and installed by the test sponsor.

A1.2 CONSTRUCTION DETAILS

A1.2.1 WALL

- A1.2.1.1 The wall frame was constructed using 64mm steel track and studs. A stud was located in the centre of the wall, and 100mm from each end to carry the plasterboard joints. The bottom track was fixed to the concrete sill with 3-off 6.5mm × 50mm long masonry anchors, and the top track was fixed to the steel restraint frame with 3-off 50mm long self tapping screws.
- A1.2.1.2 Two layers of 13mm fire-rated plasterboard was fixed to the either side of the steel stud wall with 35mm plasterboard screws at approximately 200mm spacings.

A1.2.2 PENETRATING SERVICES

- A1.2.2.2 **Service A.** A 100mm diameter brass pipe having a wall thickness of 1.3mm. The pipe extended nominal 500mm into the furnace and nominal 500mm on the non-fire exposed side. The pipe end within the furnace was capped using KAO wool.

- A1.2.2.3 **Service B.** A 150mm diameter copper pipe with a wall thickness of 1.8mm. The pipe extended nominal 100mm into the furnace and nominal 1500mm on the non-fire exposed side. The pipe end within the furnace was capped using KAO wool.
- A1.2.2.4 **Service C.** A 155mm wide × 14mm high cable tray comprised one bundle of 60 pair 0.5 PVC indoor telephone cables. The cables extended nominal 100mm into the furnace and nominal 500mm on the non-fire exposed side.
- A1.2.2.5 **Services D-G.** A 325mm wide × 45mm high cable tray comprised 1-off single core PVC insulated - PVC sheathed 630mm² 127 x 2.52mm conductors, 1-off three core plus earth PVC insulated - PVC sheathed 185mm² 37 x 2.52mm conductors, 3-off three core plus earth PVC insulated - PVC sheathed 6mm² 7 x 1.04mm conductors and 8-off three core plus earth PVC insulated - PVC sheathed 16mm² 7 x 1.7mm conductors. This tray extended nominal 100mm into the furnace and nominal 500mm on the non-exposed side.
- A1.2.2.6 All service locations are shown on Drawing 41118-TS-01.

A.1.2.3 SEALING

- A1.2.3.1 FireSound Fire Rated Acrylic Sealant was used to seal all gaps around the penetrations and wall edges on both exposed and non-exposed sides of the partition. The sealant around the penetrations was applied in fillet style.

A1.3 MATERIALS

A1.3.1 Steel Frames

- A1.3.1.1 64mm Steel studs
- A1.3.1.2 64mm Steel tracks

A1.3.2 Plasterboard

- A1.3.2.1 13mm thick Fire-rated plasterboard.
- A1.3.2.2 M6.5 x 50mm long masonry anchors used to fix the bottom tracks to the concrete sill.
- A1.3.2.3 50mm long self drilling screws used to fix the top tracks and the side studs to the steel restraint frame.
- A1.3.2.4 20mm self tapping screws to secure the studs to the tracks.
- A1.3.2.5 35mm long plasterboard screws for securing plasterboard (both layers).

A1.3.3 Services

- A1.3.3.1 1-off nominal 100mm diameter brass pipe nominal 1115mm long with a wall thickness of 1.3mm.
- A1.3.3.2 1-off nominal 150mm diameter copper pipe nominal 1800mm long, with a wall thickness of 1.8mm.
- A1.3.3.3 1-off bundle of 60 pair 0.5 PVC indoor telephone cable lengths
- A1.3.3.4 1-off single core PVC insulated - PVC sheathed 630mm² 127 x 2.52mm conductors.
- A1.3.3.5 1-off three core plus earth PVC insulated - PVC sheathed 185mm² 37 x 2.52mm conductors
- A1.3.3.6 3-off three core plus earth PVC insulated - PVC sheathed 6mm² 7 x 1.04mm conductors.
- A1.3.3.7 8-off three core plus earth PVC insulated - PVC sheathed 16mm² 7 x 1.7mm conductors.

A1.3.4 Sealant

- A1.3.4.1 FireSound Fire Rated Acrylic Sealant.

A1.3.5 Pre-test Inspection

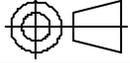
- A1.3.5.1 Upon construction completion, personnel from Warrington Fire Research (Aust.) Pty Ltd attached surface thermocouples to the unexposed face of the test specimen as specified in AS 1530.4-1997 (See drawings 41118-TS-01 and 41118-TS-02).

A1.3.6 Method of Support

- A1.3.6.1 All services were supported at nominal 100mm and 500mm from the unexposed face of the test specimen.

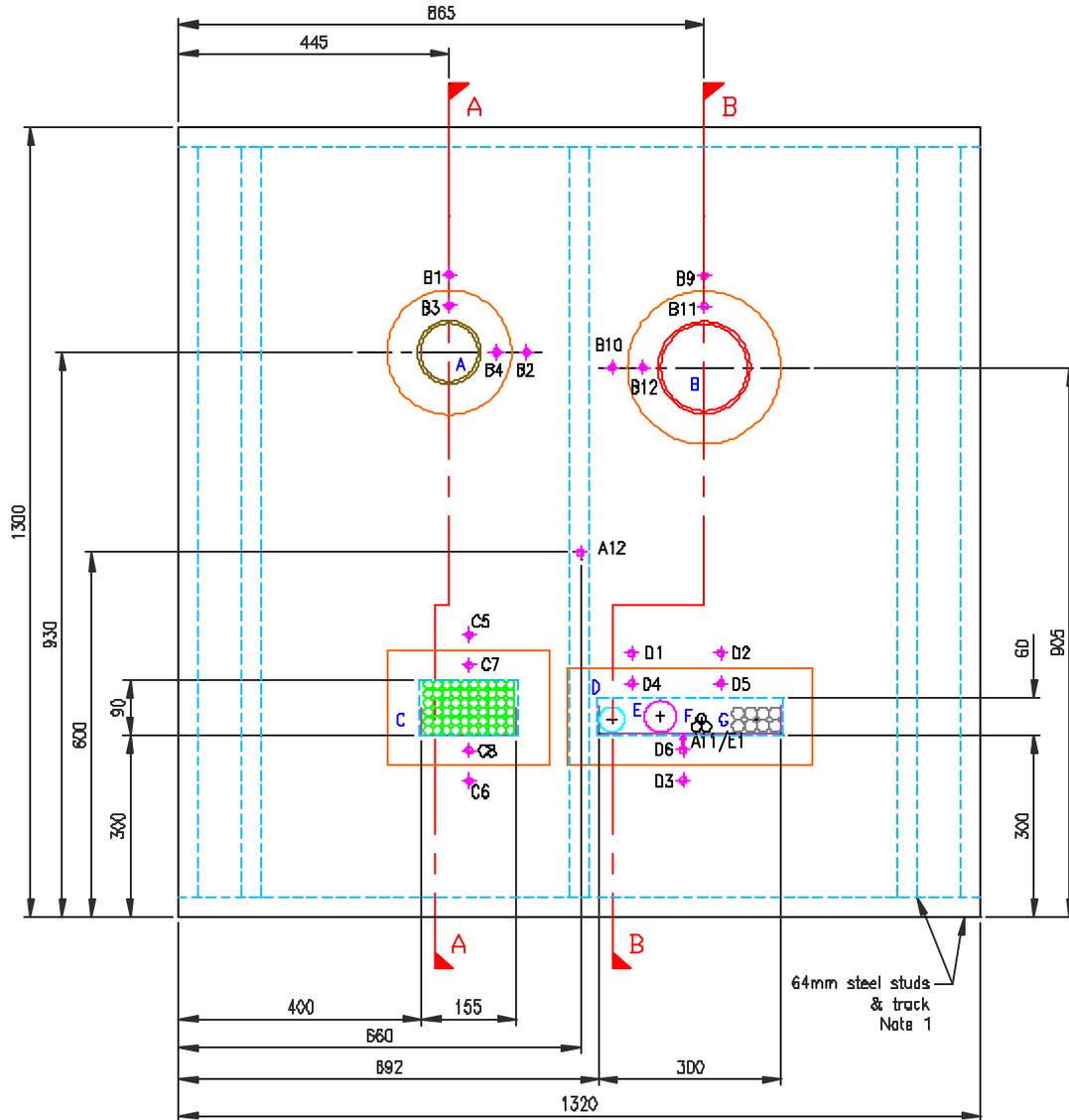
A1.4 DRAWINGS OF SPECIMEN

Drawing Designation	Description
41118-TS-01	Plasterboard Wall – Cable & Pipe penetrations – Thermocouple locations
41118-TS-02	Plasterboard Wall – Cable & Pipe penetrations – Thermocouple locations



3rd ANGLE

REVISIONS				
REV	DESCRIPTION	BY	DATE	APP
D	Issued for Report Information	AR	11/04/05	

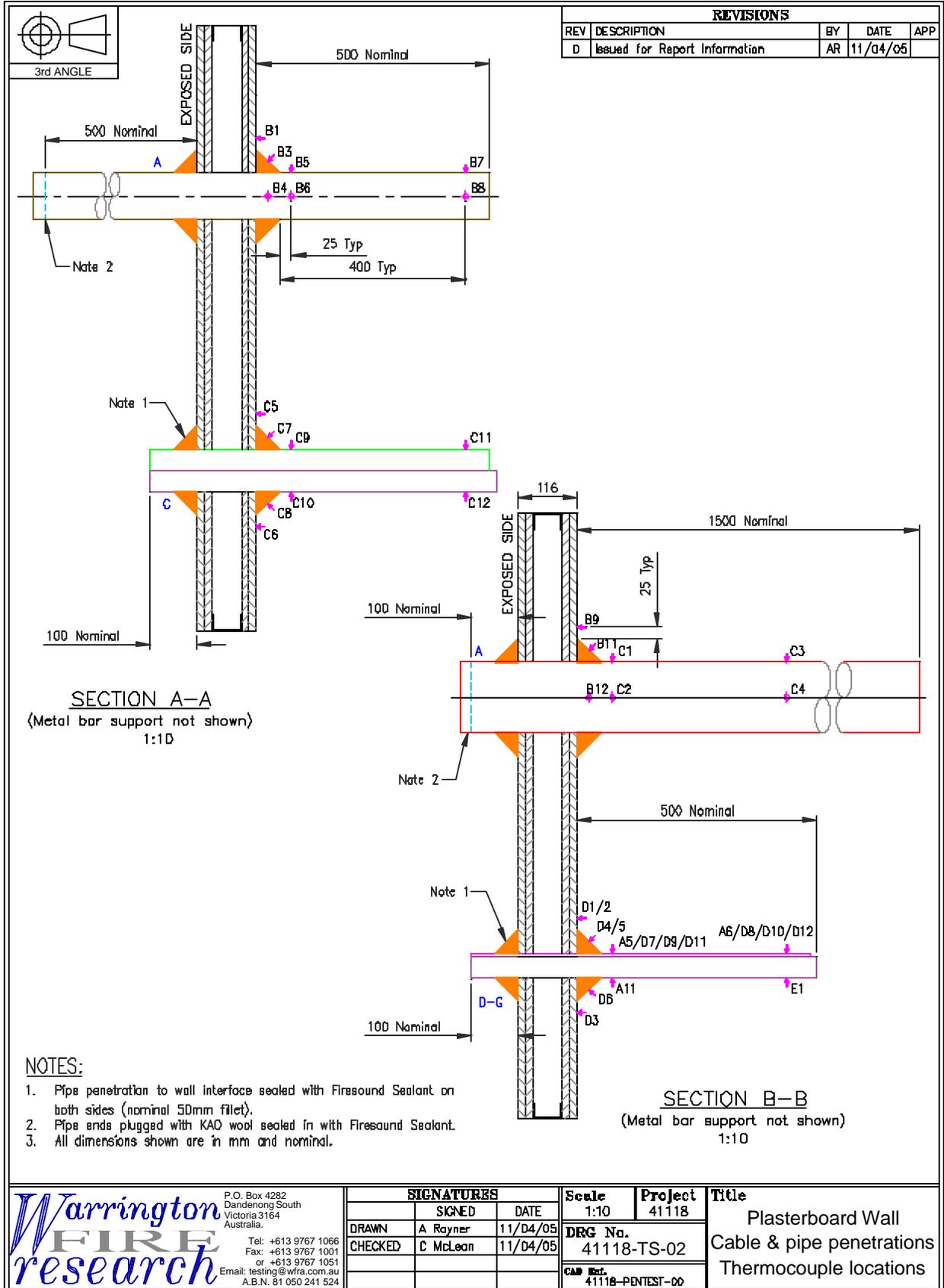


UNEXPOSED FACE ELEVATION

NOTES:

1. Wall consists of 2 layers of 13mm thick fire rated plasterboard screwfixed to either side of 64mm deep steel studs,
2. All dimensions shown are in mm and nominal.

	P.O. Box 4282 Dandenong South Victoria 3164 Australia. Tel: +613 9767 1066 Fax: +613 9767 1001 or +613 9767 1051 Email: testing@wfra.com.au A.B.N. 81 050 241 524	SIGNATURES	Scale 1:10	Project 41118	Title Plasterboard Wall Cable & Pipe penetrations Thermocouple locations													
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">DRAWN</th> <th style="width: 15%;">SIGNED</th> <th style="width: 15%;">DATE</th> </tr> </thead> <tbody> <tr> <td>A Rayner</td> <td></td> <td>11/04/05</td> </tr> <tr> <td>C McLean</td> <td></td> <td>11/04/05</td> </tr> </tbody> </table>	DRAWN	SIGNED	DATE	A Rayner		11/04/05	C McLean		11/04/05	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">DRG No.</th> <th style="width: 15%;">DATE</th> </tr> </thead> <tbody> <tr> <td>41118-TS-01</td> <td>11/04/05</td> </tr> </tbody> </table>	DRG No.	DATE	41118-TS-01	11/04/05			
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APPENDIX 2

TEST DATA AND OBSERVATIONS

Table A2.1: Test Specimen Temperatures

Service	T/C No.	Surface	Description ²	Temp (°C) at t (minutes)					Limit ¹ (Mins)
				t=0	t=15	t=30	t=60	t=98 (end)	
A	B1	P/b ³	25mm from the sealant.	21	30	56	77	120	-
	B2	P/b ³	25mm from the sealant.	21	27	52	69	113	-
	B3	Sealant	25mm from the pipe.	21	65	99	131	182	-
	B4	Sealant	25mm from the pipe.	21	74	93	111	173	-
	B5	Pipe	25mm from the sealant.	21	144	199	248	377	31
	B6	Pipe	25mm from the sealant.	21	126	183	229	349	39
	B7	Pipe	400mm from the sealant.	22	83	95	111	112	67
	B8	Pipe	400mm from the sealant.	22	68	79	92	94	68
B	B9	P/b ³	25mm from the sealant.	21	30	59	79	108	-
	B10	P/b ³	25mm from the sealant.	21	27	54	72	105	-
	B11	Sealant	25mm from the pipe.	21	69	93	135	177	-
	B12	Sealant	25mm from the pipe.	21	83	98	135	176	-
	C1	Pipe	25mm from the sealant.	21	122	231	342	377	25
	C2	Pipe	25mm from the sealant.	21	117	219	323	371	26
	C3	Pipe	400mm from the sealant.	21	55	116	169	124	-
	C4	Pipe	400mm from the sealant.	21	46	97	141	108	-

- Notes
- ¹ Limit time is the time to the nearest whole minute, rounded down to the nearest minute, at which the temperature recorded by the thermocouple does not rise by more than 180K above the initial temperature.
 - ² Refer Drawings 41118-TS-01 and 41118-TS-02 for locations of thermocouples as only a generic description is included in the table.
 - ³ P/b = Plasterboard
 - ⁴ Under limit column indicates the temperature limit was not exceeded during the test period or up until the time of integrity failure if a failure occurred (or not indicated in the case of internal thermocouples).
 - [#] Indicates a thermocouple fault or integrity failure of specimen.

Table A2.1: Test Specimen Temperatures (Cont...)

Service	T/C No.	Surface	Description ²	Temp (°C) at t (minutes)					Limit ¹ (Mins)
				t=0	t=15	t=30	t=60	t=98 (end)	
C	C5	P/b ³	25mm from the sealant.	20	25	49	64	142	-
	C6	P/b ³	25mm from the sealant.	19	22	39	60	83	-
	C7	Sealant	25mm from the cables.	20	24	48	80	102	-
	C8	Sealant	25mm from the cables.	19	23	41	73	97	-
	C9	Cable	25mm from the sealant.	20	39	73	120	235	95
	C10	Tray	25mm from the sealant.	19	29	58	90	178	-
	C11	Cable	400mm from the sealant.	21	24	32	53	81	-
	C12	Tray	400mm from the sealant.	20	20	23	32	47	-
D	A5	Cable	25mm from the sealant.	20	37	70	123	204	96
	A6	Cable	400mm from the sealant.	20	23	37	81	131	-
E	D7	Cable	25mm from the sealant.	20	32	63	111	130	-
	D8	Cable	400mm from the sealant.	20	22	32	70	99	-
F	D9	Cable	25mm from the sealant.	20	27	41	73	108	-
	D10	Cable	400mm from the sealant.	21	22	24	34	44	-
G	D11	Cable	25mm from the sealant.	19	30	55	92	119	-
	D12	Cable	400mm from the sealant.	20	22	27	44	67	-

- Notes
- ¹ Limit time is the time to the nearest whole minute, rounded down to the nearest minute, at which the temperature recorded by the thermocouple does not rise by more than 180K above the initial temperature.
 - ² Refer Drawings 41118-TS-01 and 41118-TS-02 for locations of thermocouples as only a generic description is included in the table.
 - ³ P/b = Plasterboard
 - ⁴ Under limit column indicates the temperature limit was not exceeded during the test period or up until the time of integrity failure if a failure occurred (or not indicated in the case of internal thermocouples).
 - [#] Indicates a thermocouple fault or integrity failure of specimen.

Table A2.1: Test Specimen Temperatures (Cont...)

Service	T/C No.	Surface	Description ²	Temp (°C) at t (minutes)					Limit ¹ (mins)
				t=0	t=15	t=30	t=60	t=98 (end)	
Around D-G	D1	P/b ³	25mm from the sealant.	21	25	49	66	81	-
	D2	P/b ³	25mm from the sealant.	20	24	47	64	78	-
	D3	P/b ³	25mm from the sealant.	19	21	34	59	74	-
	D4	Sealant	Centre of sealant.	20	22	46	70	92	-
	D5	Sealant	Centre of sealant.	20	22	36	67	88	-
	D6	Sealant	Centre of sealant.	19	20	28	59	80	-
	A11	Tray	25mm from the sealant.	19	22	40	62	97	-
	E1 ⁴	Tray	400mm from the sealant.	22	22	23	32	43	-
Centre of wall.	A12	P/b ³	Centre of the plaster-board wall.	20	24	45	65	101	-

- Notes
- ¹ Limit time is the time to the nearest whole minute, rounded down to the nearest minute, at which the temperature recorded by the thermocouple does not rise by more than 180K above the initial temperature.
 - ² Refer Drawings 41118-TS-01 and 41118-TS-02 for locations of thermocouples as only a generic description is included in the table.
 - ³ P/b = Plasterboard
 - ⁴ Temperature measurements taken from Adam readings.
 - ‘-’ Under limit column indicates the temperature limit was not exceeded during the test period or up until the time of integrity failure if a failure occurred (or not indicated in the case of internal thermocouples).
 - ‘#’ Indicates a thermocouple fault or integrity failure of specimen.

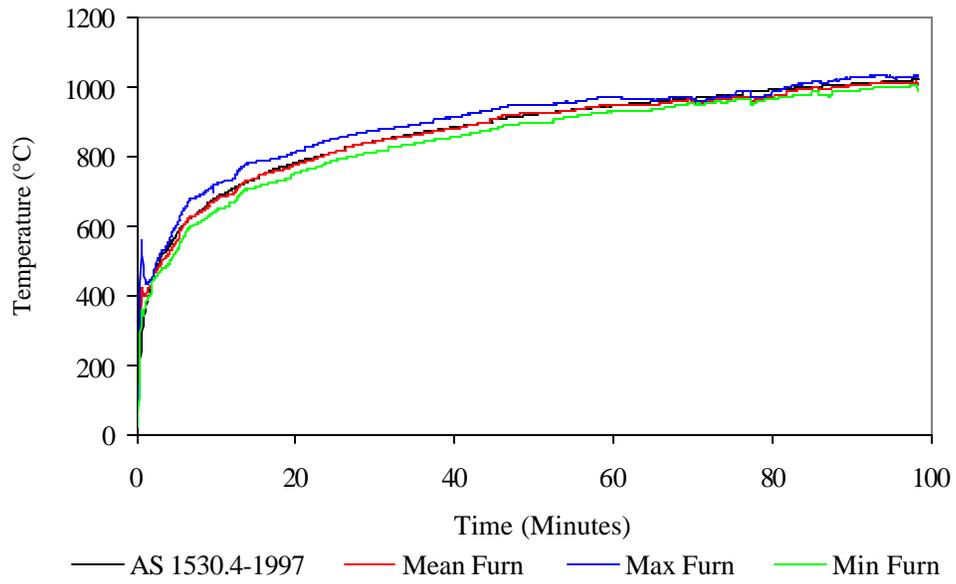


Figure A2.1: Furnace Temperatures vs Time

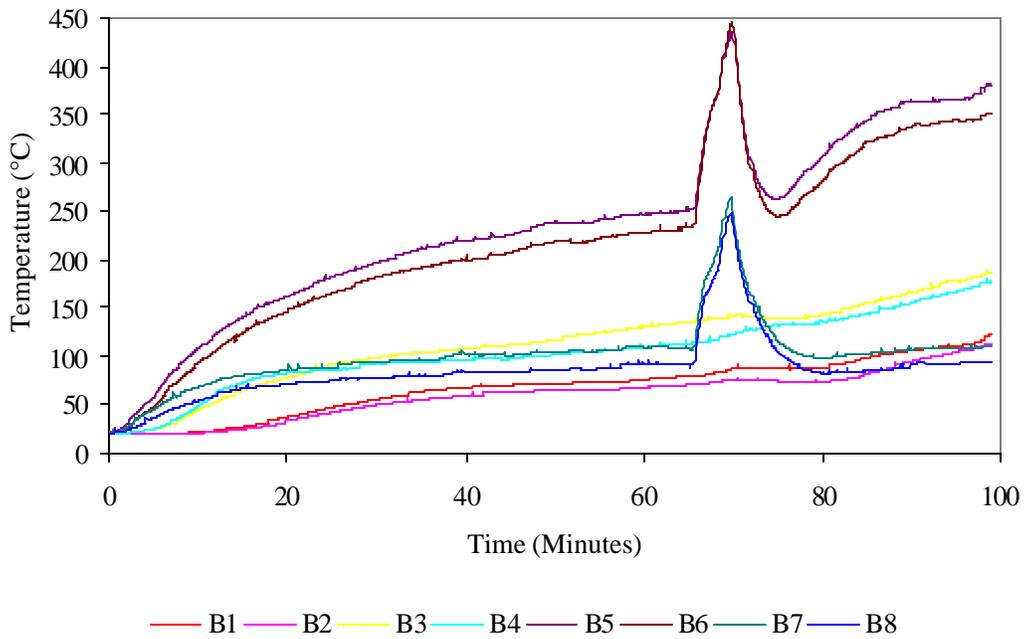


Figure A2.2 : Service A (Brass pipe). Temperatures vs Time

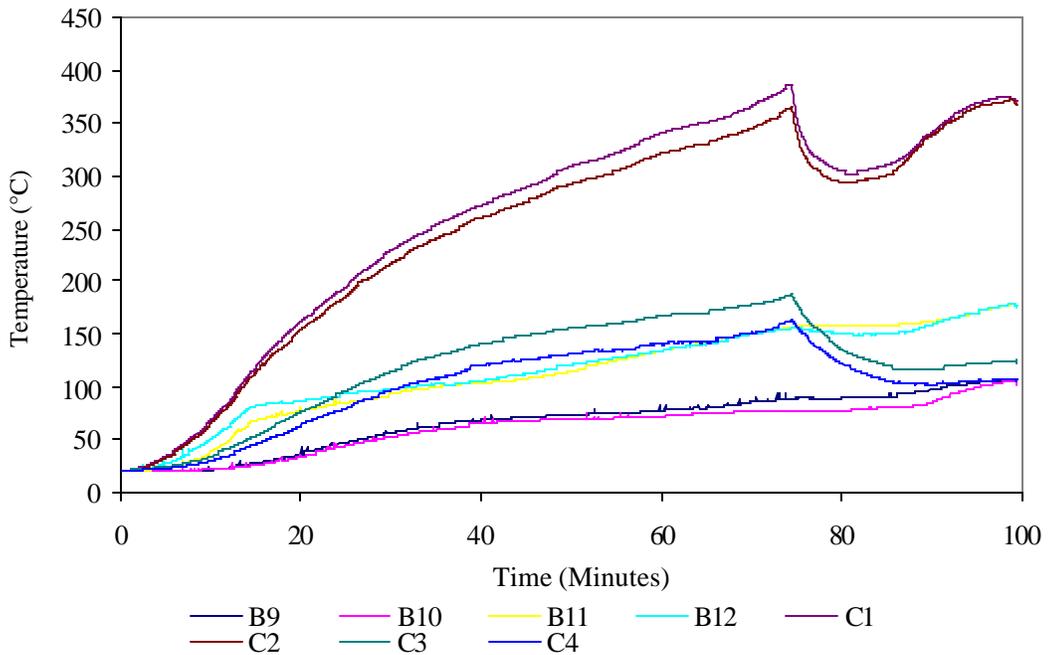


Figure A2.3: Service B (Copper pipe). Temperatures vs Time

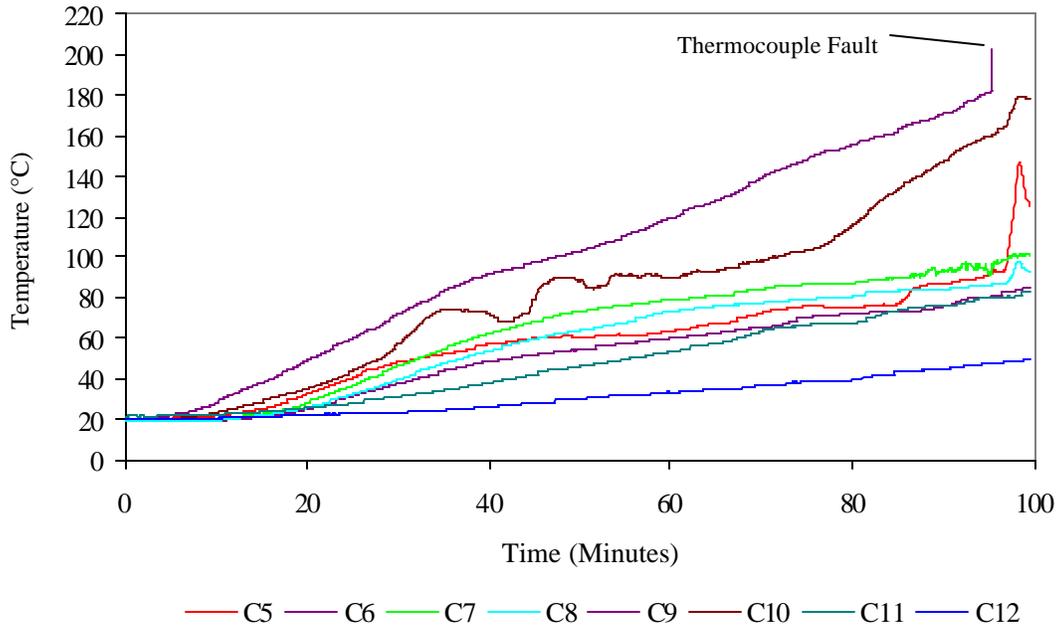


Figure A2.4 : Service C (Communications cable tray). Temperature vs Time

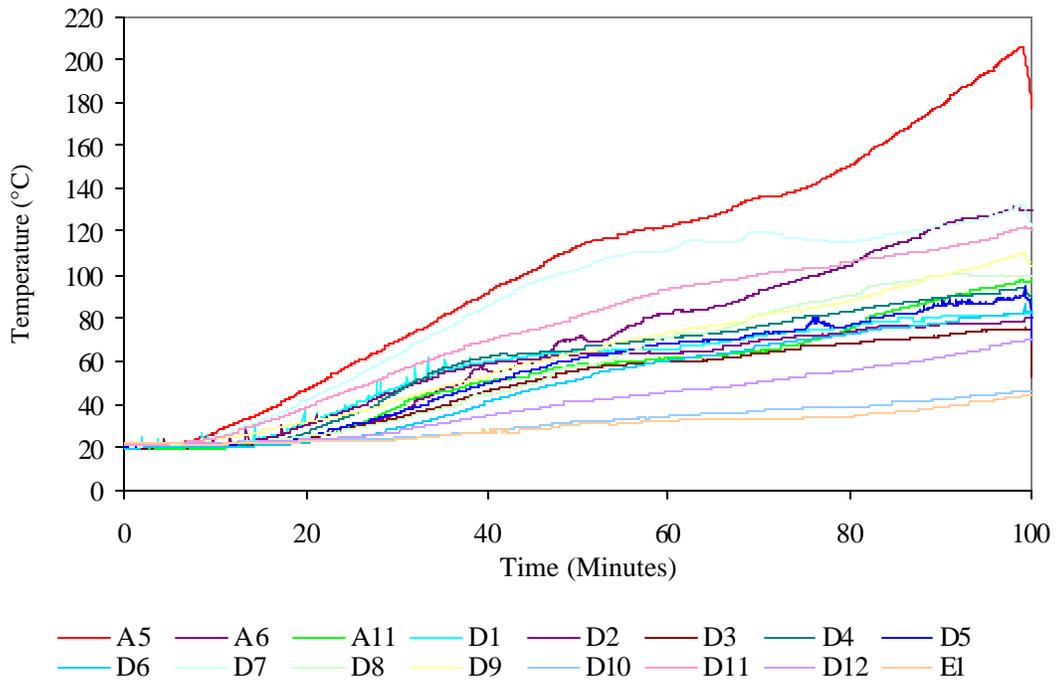


Figure A2.5: Services D-G (Electrical cable tray). Temperature vs Time

Table A2.2: Test Observations

Time		Test Observations 41118
Min	Sec	
0	00	Commencement of the fire-resistance test.
4	00	White smoke had emitted from around Service penetration C.
7	40	White smoke from Service penetration C had reduced by 70%.
10	00	Smoke from around all service penetrations had stopped.
10	27	Smoke had become evident from the inside of the copper pipe at service penetration B.
15	00	No further change to the specimen had become evident.
15	30	Face of exposed plasterboard had burned.
20	00	All penetrations had been checked, no through gaps had become evident.
25	00	All penetrations had been checked, no through gaps had become evident.
34	00	Steam emissions at Service penetration D had become evident.
40	00	No through gaps had become evident. The sealant around Service penetrations A & B on the non-fire side had swollen considerably. Some blackening of the sealant at Service penetration B.
50	00	All penetrations had been checked, no through gaps had become evident.
60	00	All penetrations had been checked, no through gaps had become evident.
70	00	All penetrations had been checked, no through gaps had become evident.
90	00	An opening had formed in the plasterboard wall, and was sealed with KAO wool. No through gaps at any Service penetration.
98	00	Test was stopped for safety reasons.

Note: All observations were taken from the unexposed side of specimen, unless otherwise stated.

APPENDIX 3

PHOTOGRAPHS

- PLATE 1: Exposed face of test specimen prior to commencement of the fire-resistance test
- PLATE 2: Unexposed face of test specimen prior to commencement of the fire-resistance test
- PLATE 3: Partition failed integrity in accordance with AS 1530.4-1997 at 98 minutes by evidence of a through gap into the furnace.
- PLATE 4: Unexposed face of test specimen after completion of the fire-resistance test
- PLATE 5: Exposed face of test specimen after completion of the fire-resistance test

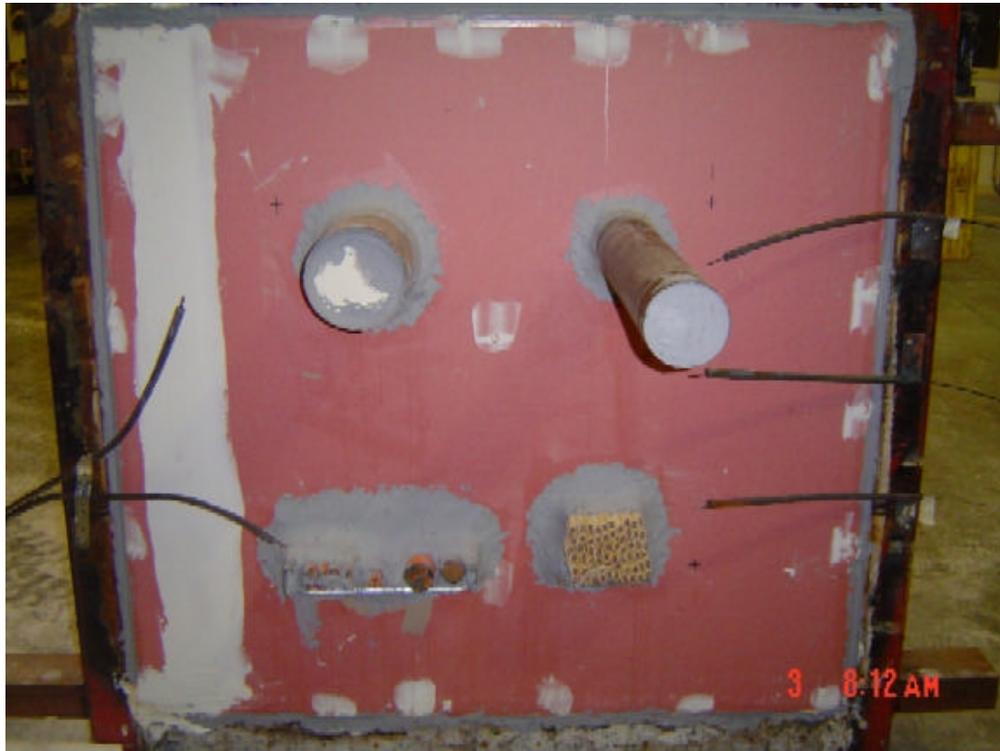


Plate 1: Exposed face of test specimen prior to commencement of the fire-resistance test



Plate 2: Unexposed face of test specimen prior to commencement of the fire-resistance test



Plate 3: Partition failed integrity in accordance with AS 1530.4 -1997 at 98 mins by evidence of a through gap into the furnace.



Plate 4: Unexposed face of test specimen after completion of the fire-resistance test

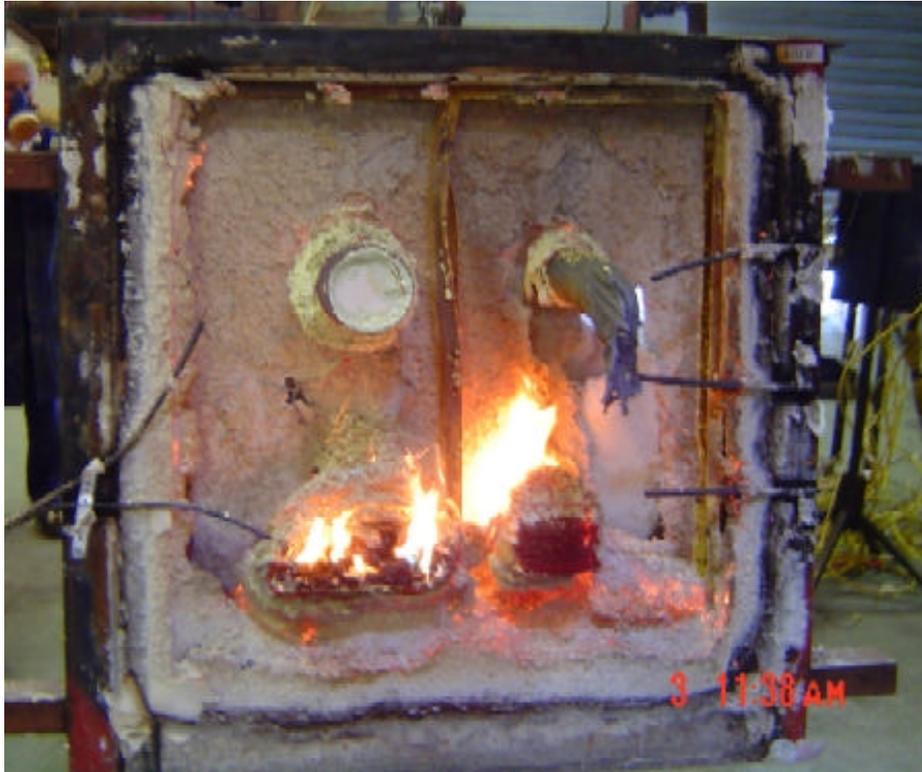


Plate 5: Exposed face of test specimen after completion of the fire-resistance test