CERTIFICATE OF CONFORMITY

Product Certification Scheme: Class 1

This Certificate is issued to:

WELL AND ABLE INTERNATIONAL PTE LTD
23 Genting Road
#03-06 Chevalier House
Singapore 349481

FOR

Product	***: Fire Rated Partition System***
Brand	***: "BESTA™"***
Model	***: Besta™ ALC Sandwich Panel***
Country of Origin	***: China***
Product Details	***: Integrity: 240 mins, Insulation: 240 mins***

which has complied with the requirements of the scheme based on the following:

STANDARD(S)	TEST REPORT(S)
AS 1530.4-1997	**Test Report No.: S07MEC0023/IHN**

Sze Thiam Siong (Mr)
General Manager
SETSCO Services Pte Ltd

Certificate No	Date of Original Issue	Date of Last Revision	Date of Expiry
FSP-2013-0018-1	**07/10/2013**	**-----**	**06/10/2016**

SETSCO

Test Report No. S07MEC0023/IHN
dated 31 Dec 2007

Note: This report is issued subject to TÜV SÜD PSB's "Terms and Conditions Governing Technical Services". The terms and conditions governing the issue of this report are set out as attached within this report.

SUBJECT:

Fire resistance test on "Godiniland" wall partition system with asymmetrical joints constructed using Autoclave Lightweight Concrete (ALC) submitted by Godiniland.

TESTED FOR:

GISS Pty Ltd
Ground Floor, 2 Mill Street
PO Box 343
Perth WA 6000
Australia

Attn: Mr. Dave Teh

DATE SUBMITTED:

26 Nov 2007

DATE OF TEST:

07 Dec 2007

PURPOSE OF TEST:

1 To determine the fire resistance of the specimen when tested in accordance with AS 1530.4-1997 "Methods for fire tests on building materials, components and structures. Part 4: Fire resistance tests of elements of building construction". The test was performed in accordance with Section 2 (General Requirements) and Section 3 (Walls and Partitions) of the standard mentioned.

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LA-2007-0380-A
LA-2007-0380-A-1
LA-2007-0381-F
LA-2007-0382-B
LA-2007-0383-G
LA-2007-0384-G
LA-2007-0385-E
LA-2007-0386-C

The results reported herein have been performed in accordance with the laboratory's terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme. Tests/Calibrations marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our laboratory.

Laboratory:
TÜV SÜD PSB Pte. Ltd.
Testing Group
No.1 Science Park Drive
Singapore 118221

Phone : +65-6885 1333
Fax : +65-6776 8670
E-mail: testing@tuv-sud-psb.sg
www.tuv-sud-psb.sg
Co. Reg : 199002667R

Regional Head Office:
TÜV SÜD Asia Pacific Pte. Ltd.
3 Science Park Drive
#04-01/05 The Franklin
Singapore 118223

TEST PROCEDURE:

2 Before the commencement of test, the ambient temperature in the general vicinity of the test specimen construction was ensured to be not exceeding 35ºC. The datum values for each individual temperature and deflection measurements were recorded not more than 15 minutes before the commencement of test.

3 During the test, with commencement of heating of the specimen, the furnace temperature and pressure were controlled to comply with the requirements specified in AS 1530.4-1997 Section 2 Clause 2.9.1, 2.9.2 and 2.9.3. The pressure was controlled such that a linear pressure gradient of 8.5±2 Pa per 1000mm height exist above a neutral pressure axis at a height of approximately 500mm above the notional floor level. However, the maximum pressure at the top of a vertical test construction shall not exceed 20Pa.

4 Throughout the course of the test, observation was made of the behaviour of the specimen for compliance with the relevant performance criteria stated in Clause 2.11 (Criteria of Failure) of AS 1530.4-1997 with emphasis on structural adequacy, integrity and insulation.

5 Mean temperature on the unexposed face of insulated specimen were measured by five number of surface mounted thermocouples, with one positioned approximately at the centre area and one approximately at centre of each quadrant.

6 Maximum temperatures on the unexposed face of insulated specimen were measured by two additional surface mounted thermocouples positioned at locations deemed to be hotter than those specified to be the average on the surface.

7 Observations, on the behaviour of the test specimen throughout the heating period, were made and recorded. As appropriate, cotton pads, gap gauges and roving thermocouple were used to establish the occurrence of failure.

8 The test was terminated when one or more failures as stated in the performance criteria occurred, or otherwise at a time agreed between the sponsor of test and the test laboratory.

PERFORMANCE CRITERIA:

9 The specimen is assessed against the following test criteria:

9.1 Structural adequacy

Failure shall be deemed to have occurred when either:

- Collapse occurs or

- Deflection or rate of deflection occurs is in excess of that specified in the relevant Section of the Standard that is applicable to the element of construction under test.

9.2 Loss of Integrity

Failure shall be deemed to have occurred when either:

- Cracks, fissures or other openings developed and through which flames or hot gases can pass on the unexposed face or upon other occurrences as set out in the relevant Section of the Standard.

9.3 Insulation

Failure shall be deemed to have occurred when one of the following occurs:-

- If the mean unexposed face temperature rises by more than 140°C above its initial value.

- If the temperature recorded of at any position on the unexposed face rises by more than 180°C above the initial temperature.

DESCRIPTION OF TEST SPECIMEN:

10 The test specimen consisted of a non load bearing 3000mm (wide) x 3000mm (high) “Godiniland” wall partition system constructed with Autoclaved Lightweight Concrete (ALC) partition wall of 100mm nominal thickness. The wall with asymmetrical joints was vertically constructed within a test frame with ordinary bricks of size 215mm x 90mm x 75mm placed along the base as lateral support and along two vertical sides of the wall. A thermal expansion gap of approximately 20mm wide filled with ceramic wool was provided along one vertical edge of the constructed wall. The test frame was mounted onto the test furnace (PSB Asset No: 20009077) and the test was conducted at TÜV SÜD PSB Pte Ltd. fire test laboratory located at No. 10 Tuas Ave 10, Singapore 639134.

11 Five panels of Autoclaved Lightweight Concrete (ALC), with the word “Siporex” stamped on the base, were vertically erected and interlocked with a tongue and groove jointing along the longitudinal edge. Each panel was reinforced with diameter 6mm steel rods embedded within the core. The nominal dimensions of each “Siporex” Autoclaved Lightweight Concrete (ALC) panel was 600mm (wide) x 3000mm (high) x 100mm (thick) and the bulk density was found to be 662kg/m^3 . Interfacing vertical joints between each panel and along the wall perimeter were grouted with ordinary cement mixture on the exposed and unexposed faces.

12 An inspection on the specimen was conducted during the construction stages by a TÜV SÜD PSB staff to verify on its material used, dimensions and designs. Details of the partition wall are as shown in Figure 2 to 4.

13 Installation of the test specimen onto the test furnace was arranged and carried out by TÜV SÜD PSB Pte Ltd.

TEST RESULTS:

14 Table 1 shows the temperature rise for the furnace and the standard curve. In addition, the table shows the percentage difference between the area under the standard curve and the area under the furnace curve compared with the percentage tolerance allowable within the standards.

15 Table 2 and 3 show the mean and maximum unexposed face temperature above the initial temperature.

16 Table 4 shows the deflection measurement of the drywall partition towards the furnace along its mid-height.

17 Figure 1 shows the actual time-temperature curve of furnace in relation to the specified time-temperature curve.

18 Photographs of the test are shown in Plates 1 to 4.

19 Observations were made during the test on the unexposed face of the test specimen and these are given in Appendix 1 of this report.

20 The results of this fire test 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 fire conditions.

CONCLUSION:

21 The specimen satisfied the requirements of the AS 1530.4-1997 for the periods stated below:

Structural adequacy	:	260 minutes
Integrity	:	240 minutes
Insulation	:	240 minutes

REMARKS:

22 Structural adequacy

No collapse of any part of the specimen wall occurred throughout the heating period of 260 minutes.

23 Integrity

At 241 minutes, a clearance of 3mm wide by 700mm long developed beneath mortar infill along the joint line between panels B and C approximately 1000mm from the wall base. Therefore, the integrity of the wall partition meets the standard for 240 minutes.

24 Insulation

At 240 minutes of test, the maximum mean temperature rise and maximum temperature rise above initial temperature on the unexposed face of specimen were 57.4°C and 64.9°C respectively. Therefore, the insulation of the wall partition meets the standard for 240 minutes.

Ismail Bin Hassan
Associate Engineer

Chan Lung Toa
Product Manager
(Fire Safety & Security Products)
Mechanical

Table 1: Comparison of area under the curve

Time (min)	Temperature rise (°C)		Area under curve (°C min)		Percentage difference (%)	Standard tolerance ±%
	Standard	Furnace	Standard	Furnace		
5.0	556.4	563.7	2038.1	2043.1	0.2	
10.0	658.4	655.4	5102.7	5094.2	-0.2	15.0
15.0	718.6	720.6	8554.8	8550.3	-0.1	
30.0	821.8	822.6	20195.3	20194.1	0.0	10.0
60.0	925.3	924.9	46579.6	46576.7	0.0	
120.0	1029.0	1029.2	105566.9	105558.2	0.0	5.0
180.0	1089.7	1090.1	169252.9	169247.1	0.0	
240.0	1132.8	1134.1	235991.4	235986.6	0.0	
260.0	1144.8	1143.4	258769.2	258764.4	0.0	

Table 2: Unexposed face temperature of the Wall Partition

Time (min)	Thermocouple no.					Mean Temp (°C)	Above initial mean temp (°C)	
	100	101	102	104	105		Mean temp	Max. temp
0.0	26.8	27.8	27.5	27.5	27.0	27.3	-	-
15.0	27.3	27.8	27.8	28.0	27.5	27.7	0.4	0.6
30.0	33.6	34.7	34.5	33.4	33.2	33.9	6.6	7.0
60.0	72.5	73.9	76.0	73.4	75.4	74.2	46.9	48.5
120.0	78.9	80.4	82.7	80.7	81.5	80.8	53.5	55.3
180.0	81.8	83.0	85.2	84.9	83.9	83.8	56.4	57.7
240.0	82.6	83.5	86.2	86.0	85.1	84.7	57.4	58.7

Note: The mean temperatures were derived from thermocouple points 100 to 102 and 104 to 105.

Table 3: Additional unexposed face temperature of the Wall Partition

Time (min)	Thermocouple no.		Mean Temp (°C)	Max. temp above initial temp (°C)
	106	108		
0.0	27.4	27.2	27.3	-
15.0	28.0	27.5	27.8	0.6
30.0	34.7	33.9	34.3	7.3
60.0	74.7	73.3	74.0	47.3
120.0	83.4	81.9	82.6	56.0
180.0	87.0	84.4	85.7	59.6
240.0	92.3	84.8	88.6	64.9

Table 4 : Deflection of the Wall Partition towards the furnace

Time (min.)	Measurement of deflection (mm)				
	A	B	C	D	E
10.0	4	6	3	1	3
20.0	4	8	5	3	3
30.0	9	10	11	9	3
45.0	11	14	14	11	3
60.0	9	14	12	10	3
90.0	6	9	8	6	3
120.0	4	5	7	2	3
150.0	4	2	0	0	1
180.0	3	2	0	0	3
210.0	4	3	2	0	0
240.0	12	26	33	14	3

Note: The measuring points at mid-height of the wall are indicated in Figure 2.

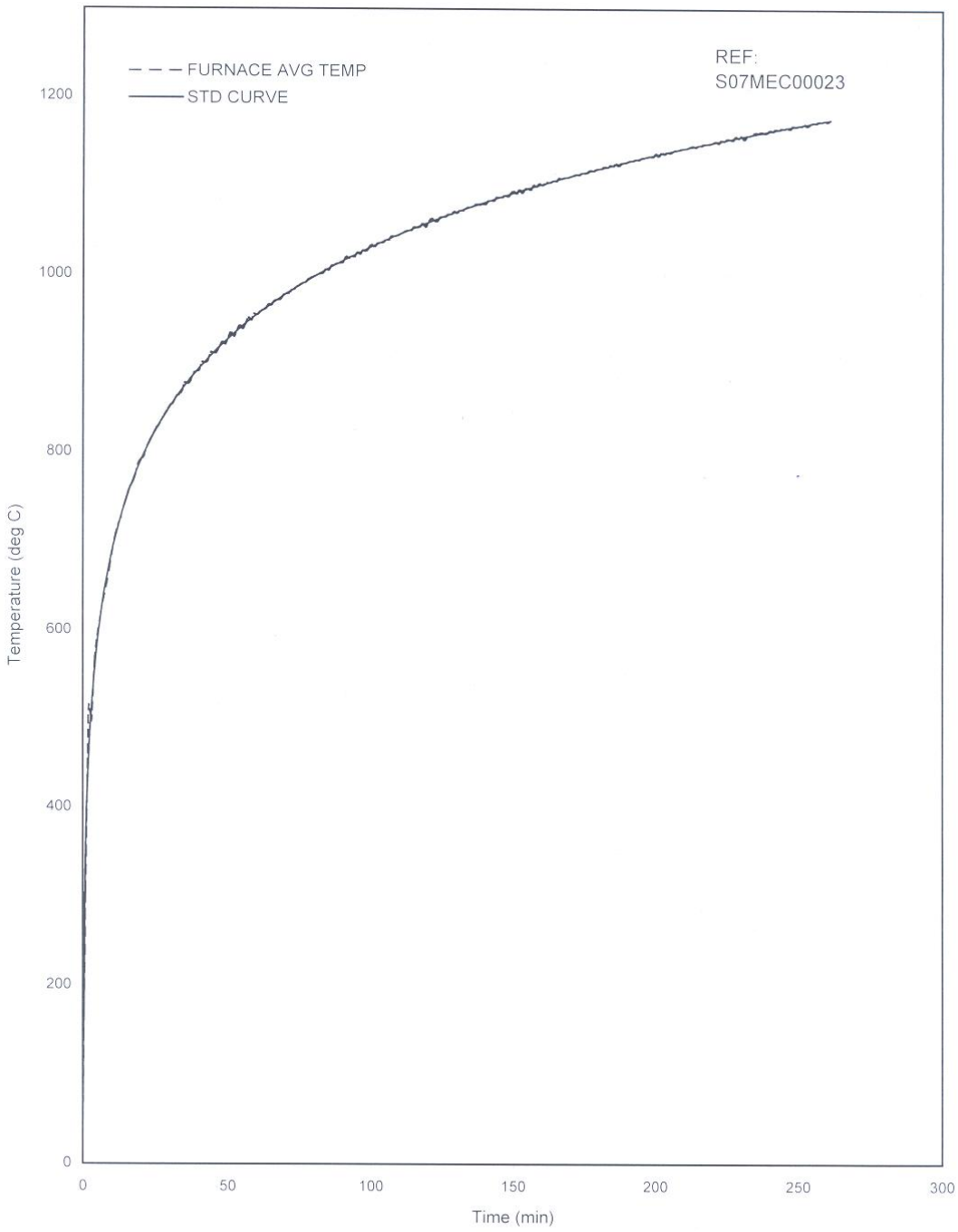

FIGURE 1: FURNACE AVERAGE TEMPERATURE

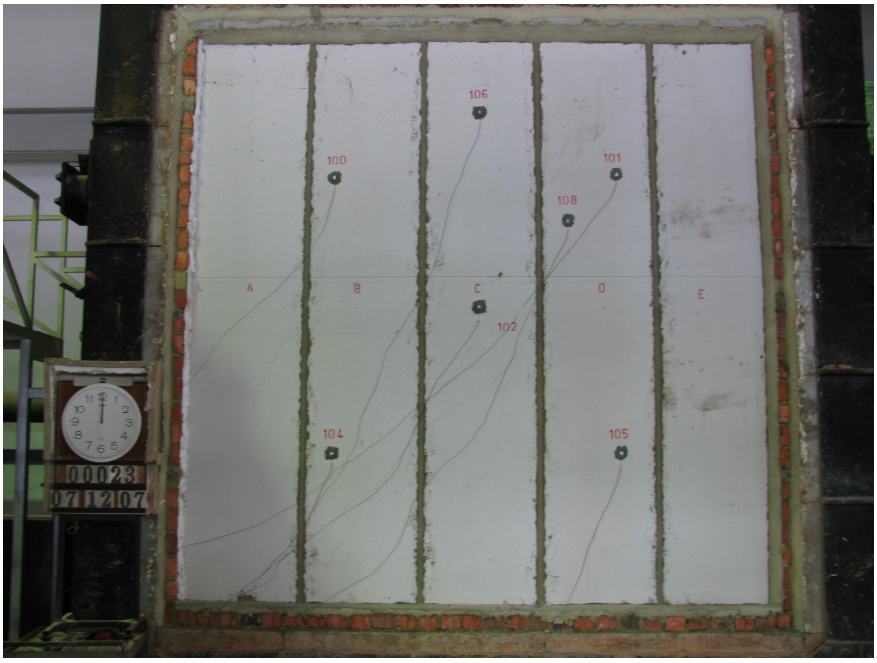

Plate 1: The unexposed face of specimen before test.

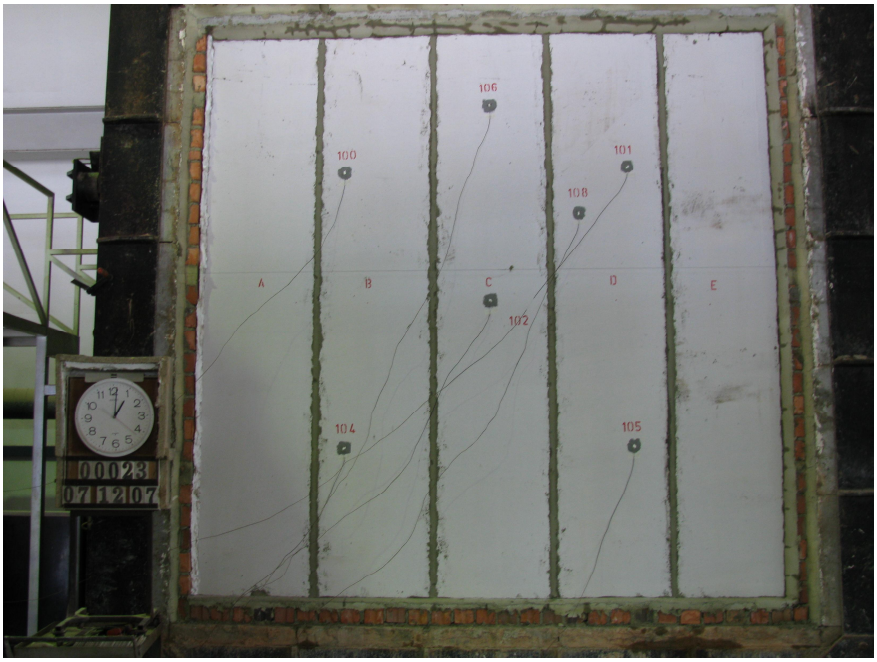

Plate 2: At about 60 minutes of test.

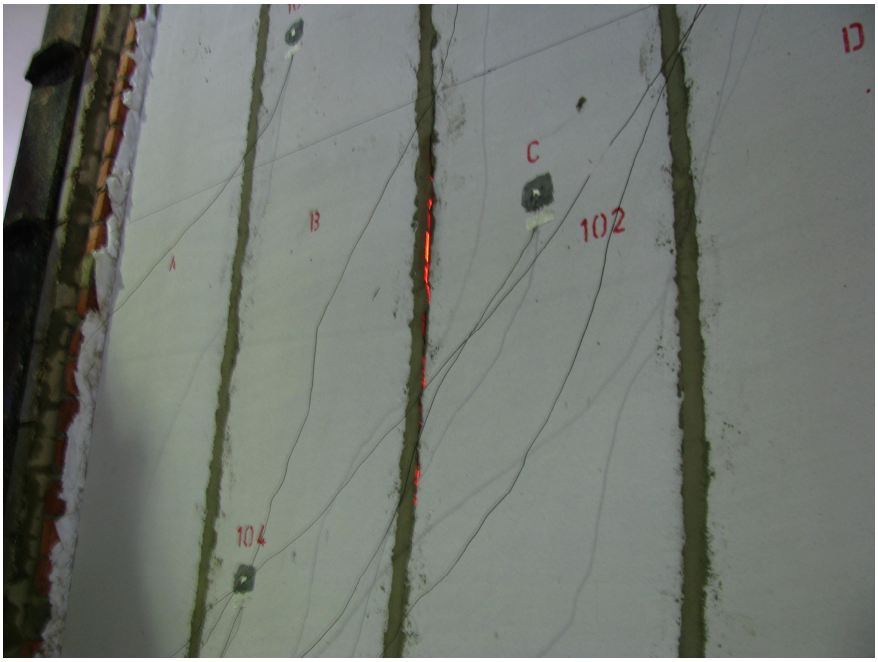

Plate 3: At about 241 minutes of test.

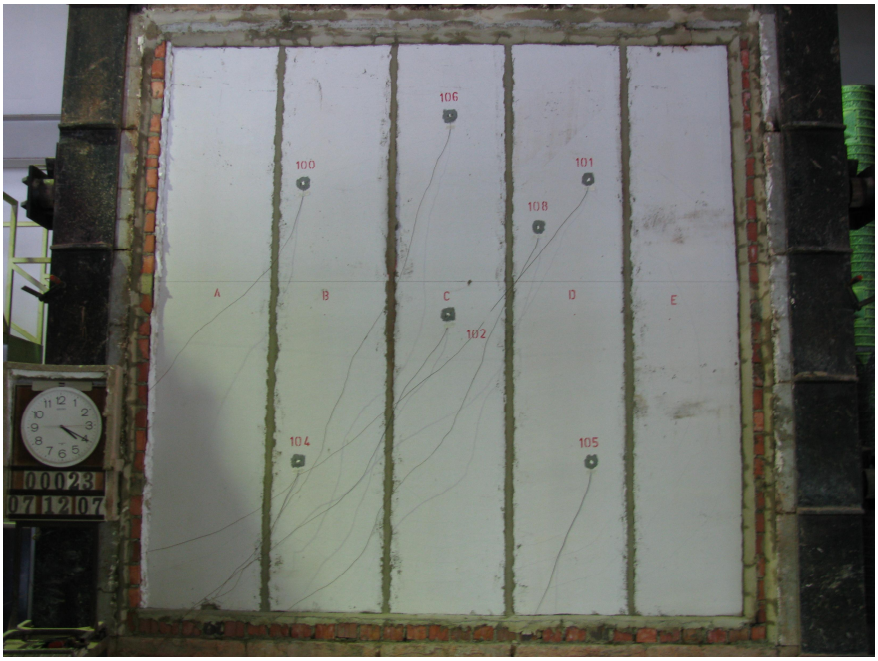

Plate 4: At about 260 minutes of test.

APPENDIX 1

Time (min:sec)	Observation on the unexposed face
00:00	Test commenced.
18:00	Small volume of smoke released from panels longitudinal joints.
30:00	Integrity of wall remained intact. Slight inward deflection was recorded across wall mid-height.
40:00	Slight clearance developed beneath mortar infill between vertical joint of panel D and E at wall mid-height.
60:00	Integrity was observed to remain intact and increased inward deflection across wall mid-height was recorded.
120:00	Integrity remained intact.
180:00	No significance occurrence was observed.
240:00	Increased inward deflection along the wall mid-height was recorded and the integrity of wall was intact.
241:00	A radiating hot opening of approximately 3mm wide by 700mm long developed beneath mortar infill along the joint line between panel B and C approximately 1000mm from wall base. **Integrity of the wall was deemed to have failed**.
250:00	A digital roving thermocouple was placed about 50mm from the radiating hot opening mentioned at 241 minutes on the unexposed face and a temperature of 225°C was recorded.
254:00	Hairline cracks begun to emerge on of all panels surface.
260:00	Test was terminated.

FIGURE 3 : SECTION A–A

'+' Indicates thermocouple points.

'–' Indicates deflection measurement points at mid–height.

FIGURE 2 : GENERAL ARRANGEMENT OF WALL ON THE UNEXPOSED SIDE

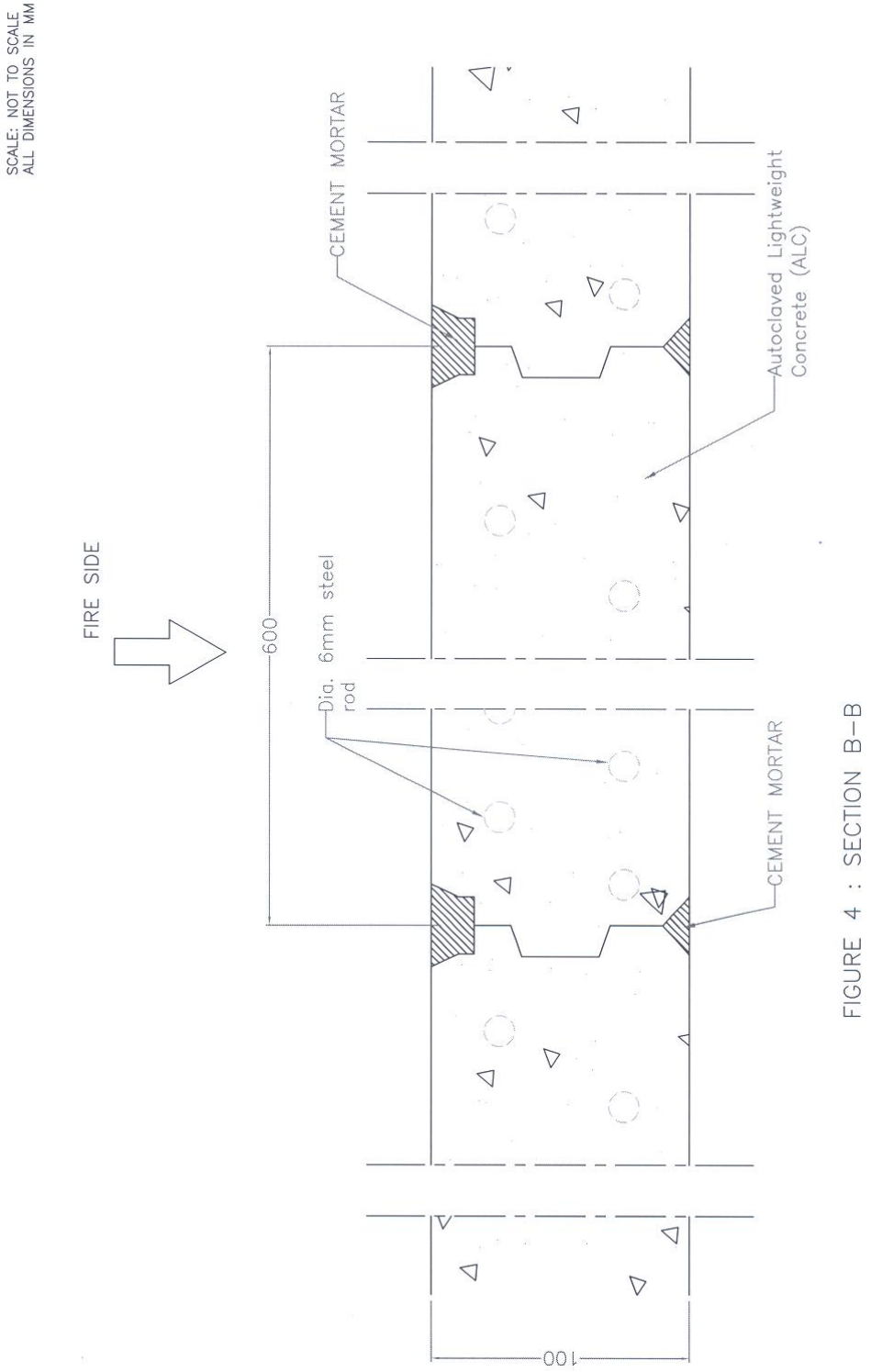

FIGURE 4 : SECTION B-B

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1. Results of the testing/calibration in the form of a report will be issued immediately after the service has been completed or terminated.

2. Unless otherwise requested, a report shall contain only technical results. Analysis and interpretation of the results and professional opinion and recommendations expressed thereupon, if required, shall be clearly indicated and additional fee paid for, by the Client.

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May 2007