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پیوست: .....

نتایج جهانی آزمایشگاهی میخ پذیری و برخورد جسم با دیوارهای اکوتک

نتایج آزمایشگاهی کشور سنگاپور با دیوارهای اکوتک

(ضخامت ۱۰۰ میلیمتر)

Test Report No. 7191047494-MEC12/01 - YX  
dated 10 December 2012



PSB Singapore

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**PERFORMANCE TEST**  
**OF**  
**PARTITION WALL SYSTEM**  
**USING**  
**GREAT WALL ULTRA LIGHTWEIGHT PANEL**  
**OF 100mm THK**  
**TESTED WITH REFERENCE TO**  
**BS 5234: Part 2: 1992 or SS 492: 2001**

**TESTED FOR:**

Lian Wang Trading Pte Ltd  
No 10 Senoko Loop  
Singapore 758148

Attn: Mr Steven Tan

**PREPARED BY:**

Ng Yui Xiong  
Associate Engineer

**APPROVED BY:**

Wong Mun Hong  
Engineer  
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Mechanical Centre

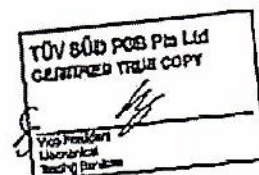


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**SUMMARY OF TEST RESULTS:**

Summary of strength and robustness tests to BS 5234 : Part 2 : 1992 or SS 492 : 2001 (Details of partition specimen and test report are attached)	
Tests for grade compliance	
Requirements tested	Grade performance achieved Severe Duty (SD)
Stiffness	Passed
Surface damage by small hard body impact, <sup>1</sup>	Tested
Surface damage by large soft body impact:	Passed
Perforation by small hard body impact:	Passed
Resistance to structural damage by large soft body impact	Passed
Door slamming	Passed

Note: - Indicates no specific criterion for acceptance is given because the impact damage will vary with different materials and forms of construction; some surface damage may be acceptable because it can be repaired. See test results photographs on page 12.

Summary of other tests on partition specimen	
Requirement tested	Performance achieved
Crowd pressure	3 kN/m
Light weight anchorage - Pull out	100 N
Light weight anchorage - Pull down	250 N
Heavy weight anchorage - (Wash basin)	1500 N
Heavy weight anchorage - (Wall cupboard)	4000 N

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6 TEST RESULTS

6.1 Partition stiffness

Date of test: 30/11/2012  
 Lab temperature / Humidity: 29 C / 60 %  
 Grade tested / load applied: Severe Duty / 500 N ± 15 N

Load (N)	Duration (min)	Deflection (mm)	Residual Deflection (mm)	Condition of the specimen tested	BS 5234: Pt 2: 1992 or SS 492: 2001 Requirements
Pretest load of 100 N	1	-	-	Passed (No damage occurred)	1) There shall be no damage or detachment, loosening or dislodgement of partition wall's parts or fixing  2) The Maximum deflection and residual deformation shall not exceed 10 & 1 mm respectively.
	2	0.02	-		
200	2	0.05	-		
300	2	0.08	-		
400	2	0.11	-		
500	2	0.14	0.01		

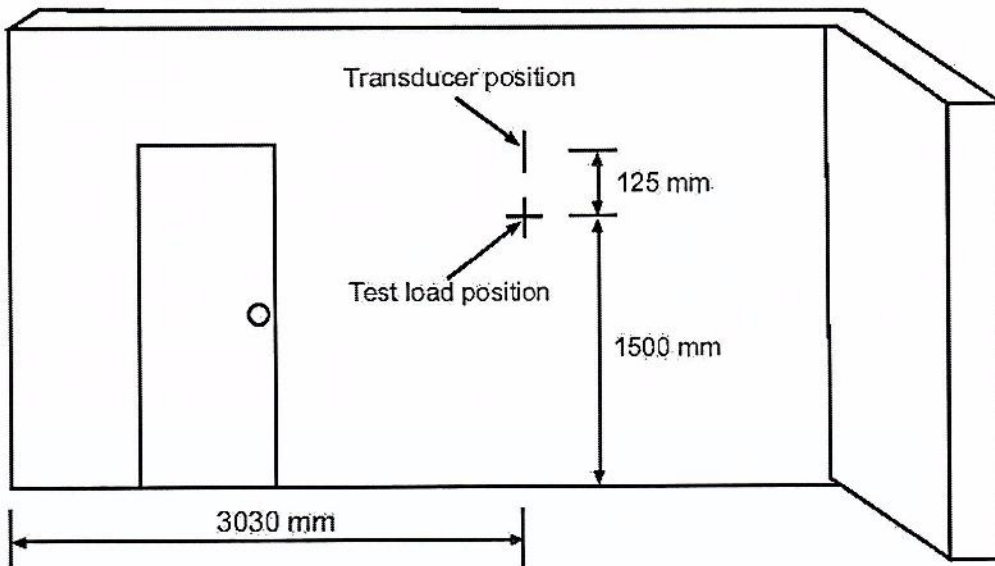


Figure 4 : Location of applied load for partition stiffness test

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6.2 Small hard body impact

6.2.1 Surface damage

Date of test: 21/11/2012  
Lab temperature / Humidity: 30 C/ 60 %  
Grade tested / load applied: Severe Duty / 10 Nm

Impact Position	Y (mm)	X (mm)	Depth of Indentation (mm)	Condition of the specimen tested	BS 5234: Pt 2: 1992 or SS 492: 2001 Requirements
1	180	2475	2.21	Tested  1) No detachment, loosening or dislodgement of its parts or fixings occurred.  2) See Fig. 9 photos for closed-up view of surface damage.	1) No specific criterion for acceptance  2) Attached photographs of surface damages for the authority judgement to be made whether can be easily repaired for acceptance
2	445		2.28		
3	720		2.24		
4	975		2.14		
5	1160		2.24		
6	180	2750	1.73		
7	470		1.88		
8	720		1.72		
9	975		1.76		
10	1160		1.28		
**11	745	75	2.26		

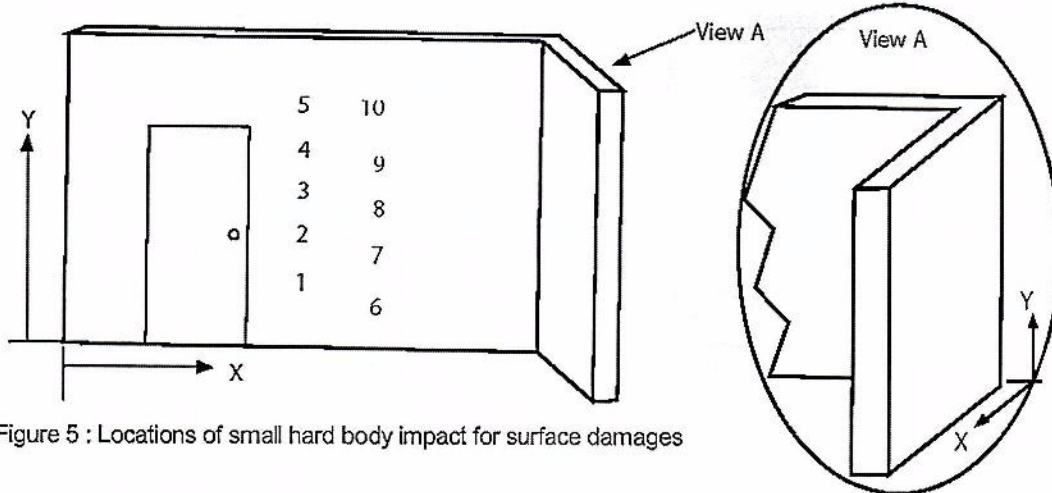


Figure 5 : Locations of small hard body impact for surface damages

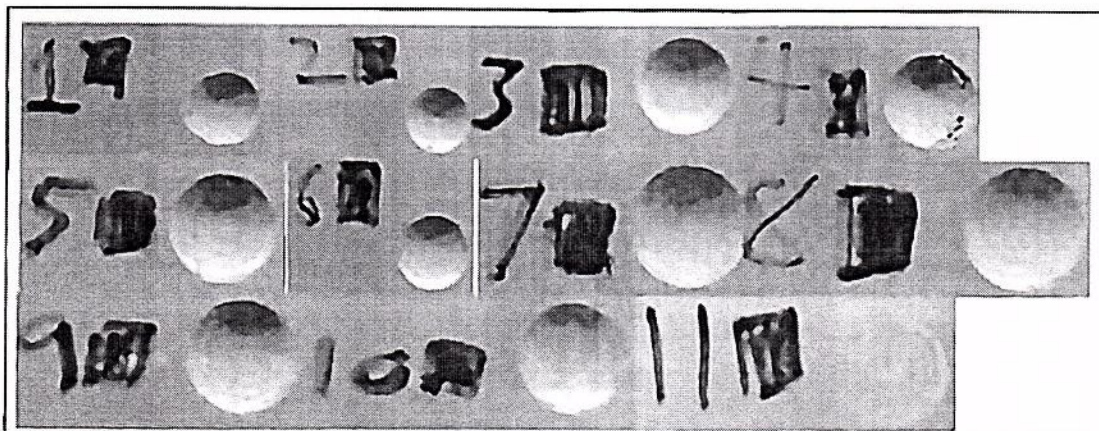


Figure 6 : Surface damage by small hard body impact - closed up view of indentations

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6.3 Large soft body impact

6.3.1 Resistance to damage

Date of test: 23/11/2012  
Lab temperature / Humidity: 29 C / 65 %  
Grade tested / Impact Energy: Severe Duty / 100 Nm

Impact Position	Y (mm)	X (mm)	Depth of indentation (mm)	Condition of the specimen tested	BS 5234: Pt 2: 1992 or SS 492: 2001 Requirements
1	1410	1913	0.02	Passed (No damage occurred)	The partition wall and a right angle junction shall be capable of withstanding the impact energies without sustaining either permanent deformation in excess of 2 mm or any damage.
2	1410	3730	0.01		
**3	1380	200	0.01		

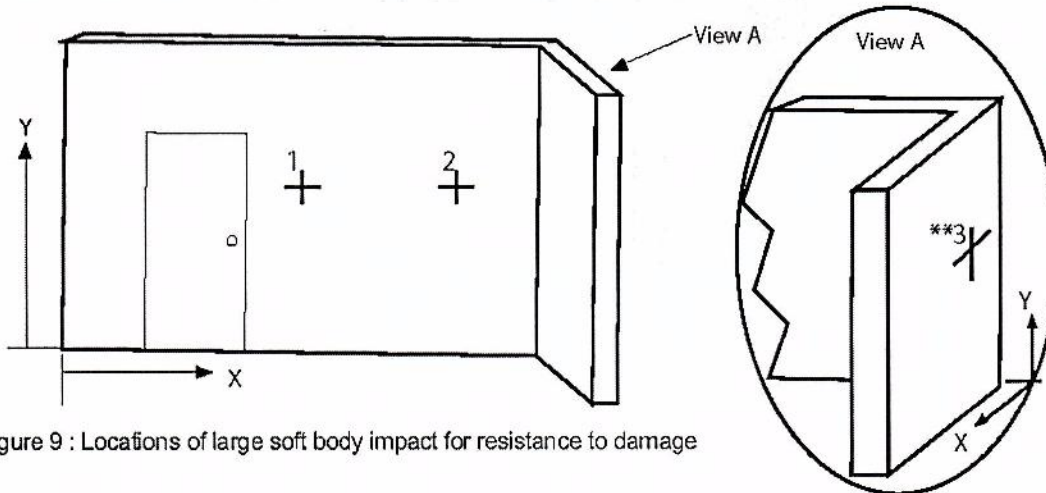
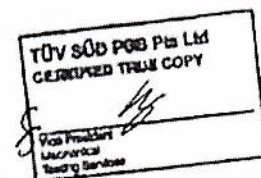


Figure 9 : Locations of large soft body impact for resistance to damage

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6.3.2 Resistance to structural damage by multiple impacts

Date of test: 23/11/2012  
Lab temperature / Humidity: 29 C / 65 %  
Grade tested / load applied: Severe Duty / 120 Nm

Impact Position	Y (mm)	X (mm)	Condition of the specimen tested	BS 5234: Pt 2: 1992 or SS 492: 2001 Requirements
1	1415	2200	Passed (No damage occurred)	The partition wall shall be capable of withstanding the impact energies, without collapsing or dislocating the partition wall or its fixings.
2	1415	3220		
**3	1450	200		

\*\*Note: Corner juncton

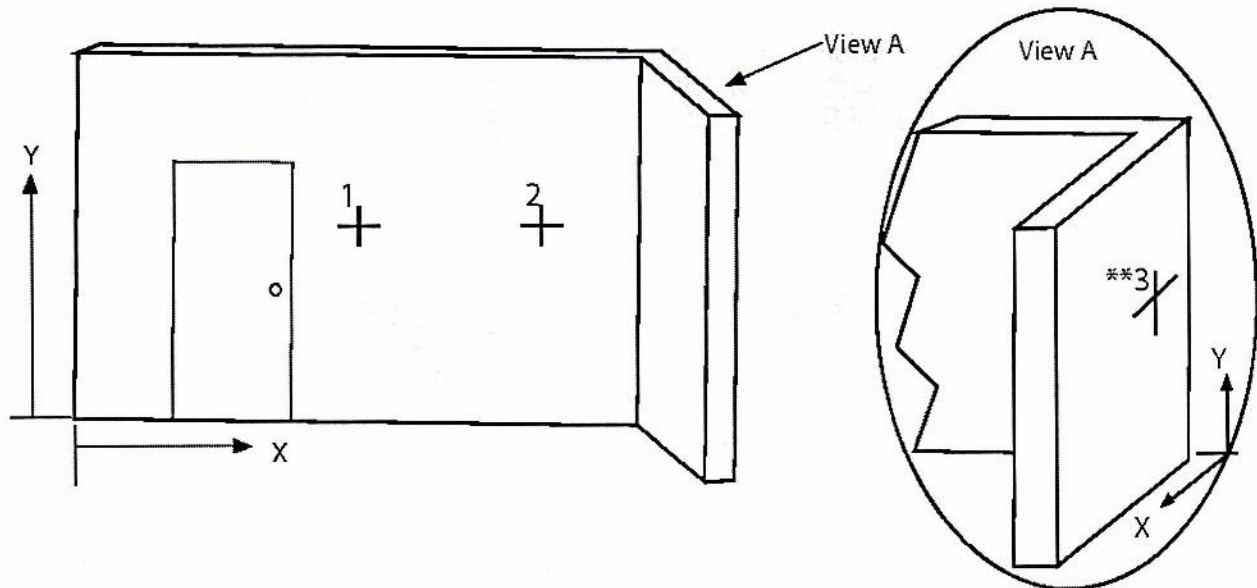


Figure 10 : Locations of large soft body impact for resistance to structural damage

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6.4 Door Slaming

Date of test: 26/11/2012  
 Lab temperature / Humidity: 29.5°C/ 62 %  
 Grade tested / load applied: Severe Duty  
 Door weight: 60kg± 0.5 kg

Number of slam (Open door to 60°)	Residual deflection (mm)	Condition of the specimen tested	BS 5234: Pt 2: 1992 or SS 492: 2001 Requirements
Pretest of 3	0.15	Passed (No damage occurred)	1) The partition shall not be damaged, nor shall door frame fittings and architraves become detached or loose after the door leaf has been slammed  2) The closing jamb of the door frame shall not be permanently displaced by more than 3mm as a result of the pre-slam test and by more than 1mm as a result the main slam test, from its position at the start of the test, measured at 1.0m above the bottom of the door leaf.
20	0.58		
100	0.82		

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6.5 Crowd Pressure

Date of test: 30/11/2012  
Lab temperature / Humidity: 29.5°C/ 65 %  
load applied: 3.0 kN/m

Load (N)	Duration (min)	Deflection (mm)	Residual Deflection (mm)	Condition of the specimen tested	BS 5234: Pt 2: 1992 or SS 492: 2001 Requirements
Pretest load of 100 N	1	0.02	0.02	Passed (No damage occurred)	There shall be no collapse or damage that would render the partition wall dangerous, due to any of its parts becoming dislodged or shattered, in a manner that could cause injury.
3.0 kN/m	2	1.22	0.15		

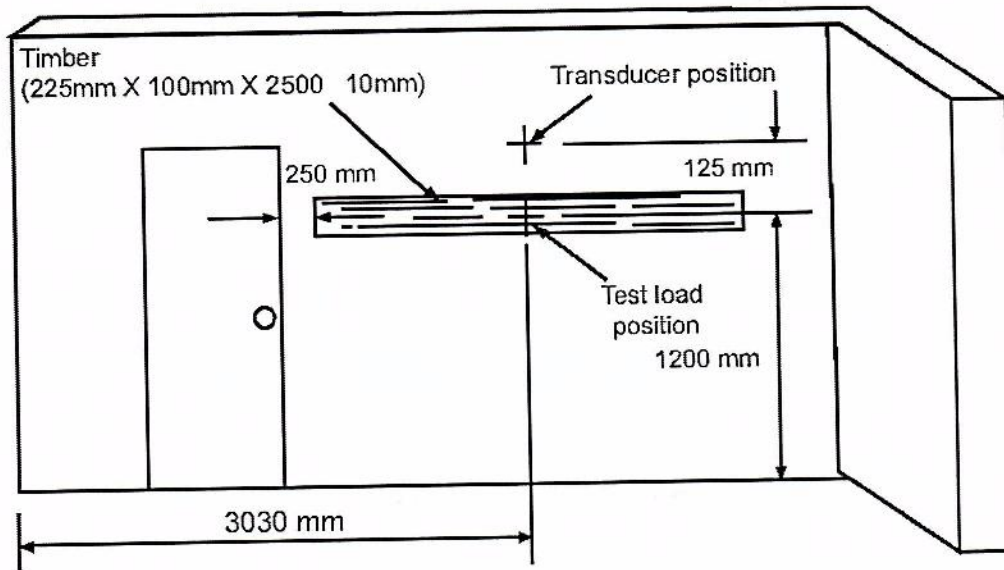


Figure 11 : Location of applied load for crowd pressure

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6.6 Lightweight Anchorage

6.6.1 Pull-out test

Date of test: 27/11/2012  
 Lab temperature / Humidity: 30° C/ 58 %  
 load applied: 100 N ±3 N

Load (N)	Duration (min)	Condition of the specimen tested	BS 5234: Pt 2: 1992 or SS 492: 2001 Requirements
100	1	Passed (No damage occurred)	The partition wall shall withstand the axial load without releasing the pull-up shim plate or damaging the partition other than superficial cracking

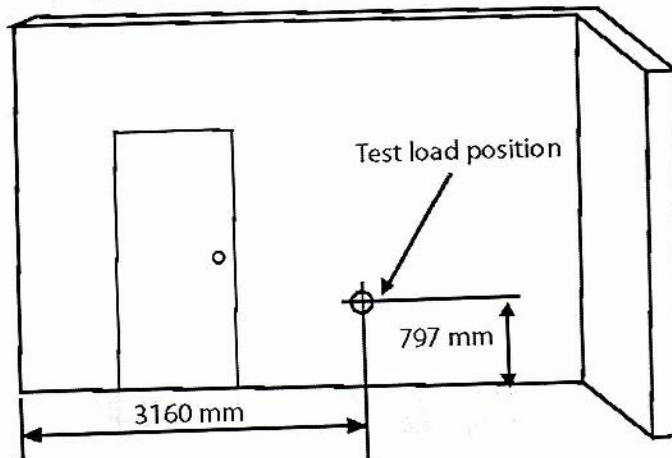


Figure 12 : Locations of applied load for lightweight anchorage Pull-out test

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6.6.2 Pull-Down test

Date of test: 27/11/2012  
 Lab temperature / Humidity: 30°C/ 64 %  
 load applied: 250 N ±3 N

Load (N)	Duration (min)	Deflection (mm)	Condition of the specimen tested	BS 5234: Pt 2: 1992 or SS 492: 2001 Requirements
250	1	0.02	Passed (No damage occurred)	1) The partition wall shall withstand the transverse load without releasing the pull-up shim plate or damaging the partition other than superficial cracking.  2) The maximum movement of the pull-down bracket shall not exceed 2mm.

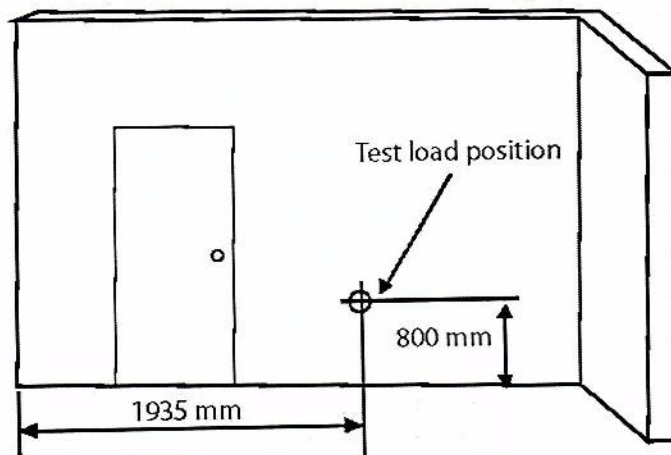


Figure 13 : Locations of applied load for lightweight anchorage Pull-down test

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6.7 Heavyweight Anchorage

6.7.1 Wash basin

Date of test: 27/11/2012  
Lab temperature / Humidity: 30°C/65 %  
load applied: 1500 N

Load (N)	Time (min)	Deflection (mm)				Residual deflection (mm)				Condition of the specimen tested
		1	2	3	4	1	2	3	4	
Pretest load of 200	1	-0.02	-0.03	0.00	-0.01	0.02	0.00	0.00	0.00	Passed (No damage occurred)
500	1	0.00	-0.02	-0.03	-0.03	-	-	-	-	
750	1	0.00	0.01	-0.05	-0.05	-	-	-	-	
500	1	0.00	0.00	-0.03	-0.03	-	-	-	-	
750	1	0.00	0.00	-0.06	-0.05	-	-	-	-	
500	1	0.00	0.02	-0.04	-0.03	-	-	-	-	
1000	1	0.00	-0.00	-0.06	-0.07	-	-	-	-	
500	1	0.00	-0.03	-0.05	-0.05	-	-	-	-	
1000	1	-0.02	-0.02	-0.07	-0.07	-	-	-	-	
500	1	-0.01	0.01	-0.03	-0.03	-	-	-	-	
1250	1	-0.02	-0.03	-0.08	-0.08	-	-	-	-	
500	1	0.00	0.02	-0.04	-0.03	-	-	-	-	
1250	1	-0.02	-0.04	-0.08	-0.08	-	-	-	-	
500	1	-0.01	0.02	-0.03	-0.03	-	-	-	-	
1500	1	-0.03	-0.04	-0.09	-0.10	-	-	-	-	
500	1	0.00	-0.02	-0.03	-0.02	-	-	-	-	
1600	1	-0.03	-0.04	-0.09	-0.10	-	-	-	-	
500	1	0.00	-0.02	-0.02	-0.02	0.00	0.03	0.02	0.01	

BS 5234: Pt2: 1992  
or SS 492: 2001 Requirements

The anchorages shall be capable of withstanding the load selected applied to the 2 linked brackets without releasing either pull-up shim plate, exceeding 5 mm deflection or 1mm residual deformation limits and without loosening, detaching or damaging the partition wall.

Note : All fasteners for attaching the brackets to the partition wall were secured to the studs.

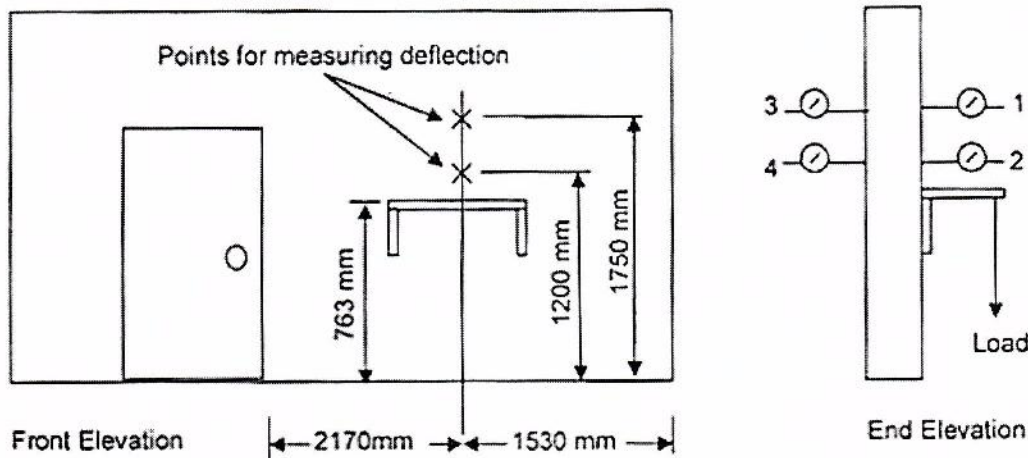


Figure 14 : Locations of applied load for heavyweight anchorage  
(Wash basin) eccentric download loading test

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6.7.2 Wall cupboard

Date of test: 27/11/2012  
Lab temperature / Humidity: 29.5°C / 65 %  
load applied: 4000 N

Load (N)	Time (min)	Deflection (mm)				Residual deflection (mm)				Condition of the specimen tested
		1	2	3	4	1	2	3	4	
Pretest load of 200	1	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	Passed (No damage occurred)
500	1	0.00	-0.02	0.02	0.03	-	-	-	-	
1000	1	-0.05	-0.06	0.05	0.07	-	-	-	-	
1500	1	-0.07	-0.09	0.08	0.10	-	-	-	-	
2000	1	-0.09	-0.12	0.10	0.13	-	-	-	-	
2500	1	-0.11	-0.15	0.13	0.17	-	-	-	-	
3000	1	-0.13	-0.19	0.15	0.21	-	-	-	-	
3500	1	-0.16	-0.21	0.17	0.25	-	-	-	-	
4000	1	-0.21	-0.29	0.19	0.30	0.01	0.02	0.05	0.03	

BS 5234: Pt2: 1992 or SS 492: 2001 Requirements	The anchorages shall be capable of withstanding the load selected applied to the 2 linked brackets without releasing either pull-up shim plate, exceeding 5 mm deflection or 1mm residual deformation limits and without loosening, detaching or damaging the partition wall.
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Note : All fasteners for attaching the brackets to the partition wall were secured to the studs.

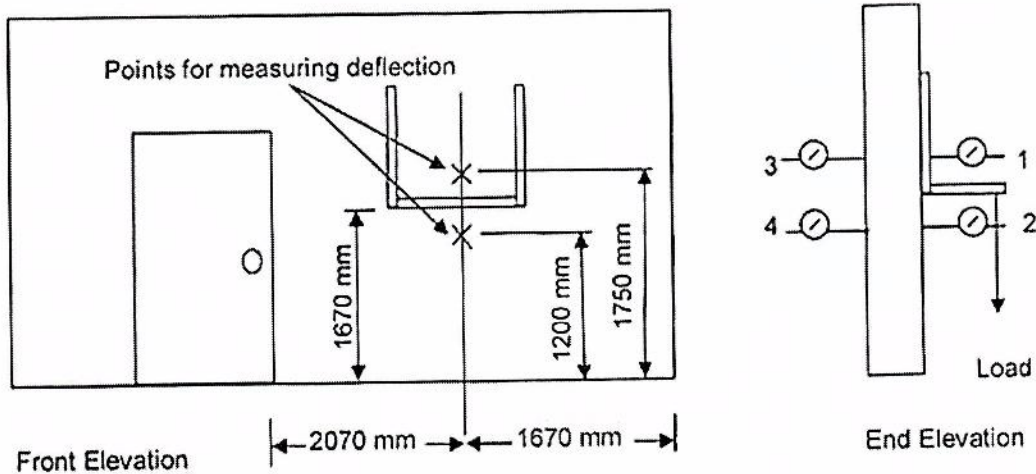


Figure 15 : Locations of applied load for heavyweight anchorage  
(High level wall cupboard) eccentric download loading test

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**CONCLUSION**

Great Wall Ultra Lightweight Panel of 100mm THK meets the **SEVERE DUTY** grade requirements of Bs 5234 Part 2: 1992 or SS 492:2001

Mahaphant Shera fibercement wall has also achieved the following performance:

Crowd presure	:	3.0kN/m
Light weight anchorage - pull out	:	100 N
Light weight anchorage - pull down	:	250 N
Heavy weight anchorage - wash basin	:	1500 N
Heavy weight anchorage - wall cupboard	:	4000 N

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