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TEST REPORT

Lucideon Reference:	153788 (Emails 26.8.15 &17.9.15)/Ref. 1
Project Title:	Racking Strength and Stiffness of Timber Framed Wall Panels
Client:	Black Mountain Insulation Ltd Bradwell Hall Bradwell on Sea Essex CM0 7HX
For the Attention of:	Tony Reed
Author(s):	Miss Lisa Cobden
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Work Location:	Lucideon UK

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Miss Joanne Booth
Consultancy Team
Reviewer

Miss Lisa Cobden
Consultancy Team
Project Manager

Lucideon Limited
Queens Road, Penkhull
Stoke-on-Trent
Staffordshire ST4 7LQ

T +44 (0)1782 764428
enquiries@lucideon.com
www.lucideon.com

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1 INTRODUCTION

Black Mountain Insulation Ltd supplied MagPly sheathing boards to be installed onto timber frame panels made at Lucideon, to establish racking resistance in accordance with BS EN 594:2011 Timber Structures – Test Methods. Racking strength and stiffness of the panel were determined according to Section 6.5 of BS EN 594:2011.

2 TEST PROGRAMME

The samples were received and tested under racking load when subjected to different vertical top loading conditions, as follows:

Panel Reference	Vertical Top Load at 600 mm Centres (kN)	Tests	Sheathing Board Thickness (mm)	Perimeter Nailing Centres (mm)	Intermediate Nailing Centres (mm)
MagPly Sheathing Board	0	3	9	150	300
	5	3			

3 SAMPLE DESCRIPTION

Each timber frame panel was of overall size 2400 x 2400 mm and comprised 38 x 89 mm C16 studs at nominally 600 mm centres, together with a single bottom rail and single top rail. A head binder was used above the top rail but not fixed to the sheathing.

The studs were fixed to the top and bottom rail using 2 x 3.1 mm x 90 mm long ring shank nails per stud, at the base and top rails.

1.2 m x 2.4 m x 9 mm thick MagPly sheathing boards were nailed to the face of the timber frame at 150 mm centres to the perimeter and 300 mm centres to the internal studs, using 2.9 mm x 50 mm smooth nails.

The general arrangement of the panel and fixing positions is shown in Figure 1.

4 TEST PREPARATION

100 mm diameter holes were cut in the base rail, centred at the anchorage points of the base rig. M16 x 150 mm long bolts were inserted through the holes with large steel plates attached (50 mm wide x 220 mm long x 10 mm thick).

The test panel was bolted to the test rig through a 38 x 89 mm C16 timber rail such that the bottom rail was fixed down by 5 No. M16 x 150 mm long bolts in line with BS EN 594:2011 and shown in Figure 2. The panel was laid flat in the test rig which had been bolted down to the laboratory strong floor. The panel was placed on Teflon coated timber packers to allow it to move freely when loading.

Hydraulic rams were fixed to the test rig at the panel header end such that they would be able to apply a vertical top load to the panel at the 600 mm centres.

In accordance with Figure 3 of BS EN 594:2011, linear voltage displacement transducers (LVDT's) were fixed in place so as to record horizontal deflection at the head of the panel (Displacement 1), at the base of the panel (Displacement 2) and to measure any uplift at the base of the panel (Displacement 3). The positions are shown in Figure 2 along with a general view of the test arrangement.

The temperature and humidity as measured by a calibrated hygrometer was 21.8°C and 55.6% RH.

5 METHOD OF TEST

5.1 0 kN Vertical Load per Stud

Using hydraulic rams linked via a common manifold, a vertical pre-load of 1 kN/stud was applied to the panel and left for 2 minutes prior to removal. The panel was then allowed to recover for 5 minutes before applying a racking load at a loading rate such that 90% of the maximum load of the panel was achieved within 300 seconds ± 200 seconds.

5.2 5 kN Vertical Load per Stud

A vertical load of 5 kN/stud was applied to the panel and maintained for the duration of the test. A racking load was applied at a loading rate such that the 90% of the maximum load of the panel was achieved within 300 seconds ± 200 seconds.

6 RESULTS

The ultimate racking loads, the racking stiffness and basic test racking resistance are given in Table 1. The density and moisture content of the timber frames are given in Table 2 respectively.

Graphs of applied racking load against deflection are given in Charts 1 and 2.

The typical failure modes are shown in Plate 2-5.

7 DISCUSSION

According to BS 5268-6.1[1] a Category 1 material (9.5 mm plywood, 9.0 mm medium board, 12.0 mm chipboard, 9.0 mm OSB) nailed at a maximum spacing of 150 mm on perimeter and 300 mm on internal studs should give a Racking resistance of 1.68 kN/m.

[1] BS 5268-6.1 Structural use of timber. Part 6 code of practice for timber frame walls. Part 6.1 Dwellings not exceeding seven stories

The 9 mm thick MagPly sheathed timber frame panels nailed at 150 mm centres to the perimeter and 300 mm centres to the internal studs achieved calculated basic test racking resistance values of 1.72 kN/m with no vertical load and a value of 1.69 kN/m with 5 kN per stud applied vertical load.

Table 1 - Summary of Racking Loads for Panels Tested with 9 mm MagPly Sheathing Boards Fixed at 150 mm Centres to the Perimeter and 300 mm Centres to the Internal Studs

Panel	Load per Stud (kN)	Racking Stiffness (N/mm)	Racking Strength Fmax (kN)	Basic Test Racking Resistance to BS 5268-6.1 (kN/m)	Mode of Failure
1	0	1140	7.17	1.72	Withdrawal of leading stud with splitting of base rail and failure of sheathing board at base rail- fixings pulling through. (Plates 2 and 3)
2		739	7.21		
3		774	7.20		
Mean	**-**	**884**	**7.00**	**-**	**-**
1	5	1279	12.41	1.69	Failure of board around fixings with differential movement between panels. (Plates 4 and 5)
2		1374	13.88		
3		2517	13.97		
Mean	**-**	**1723**	**13.42**	**-**	**-**

Table 2 - Density and Moisture Content of the Timber Frames

Sample No.	Moisture Content (%)	Density (kg/m³)
1	11.3	419
2	12.1	416
3	12.4	423
4	11.2	436
5	11.6	420
6	11.9	422

Plate 1 - General View of Racking Test Arrangement

Plate 2 – Typical Mode of Failure after 0 kN Vertical Top Load Tests

Plate 3 – Typical Mode of Failure after 0 kN Vertical Top Load Tests

Plate 4 – Typical Mode of Failure after 5 kN Vertical Top Load Tests

Plate 5 – Typical Mode of Failure after 5 kN Vertical Top Load Tests

NOTE: The results given in this report apply only to the samples that have been tested.

END OF REPORT

Chart 1 - Load-Deflection Curve for Racking Tests on 9 mm Magply Sheathing Boards with 150/300 mm Nailings with 0 kN Top Load

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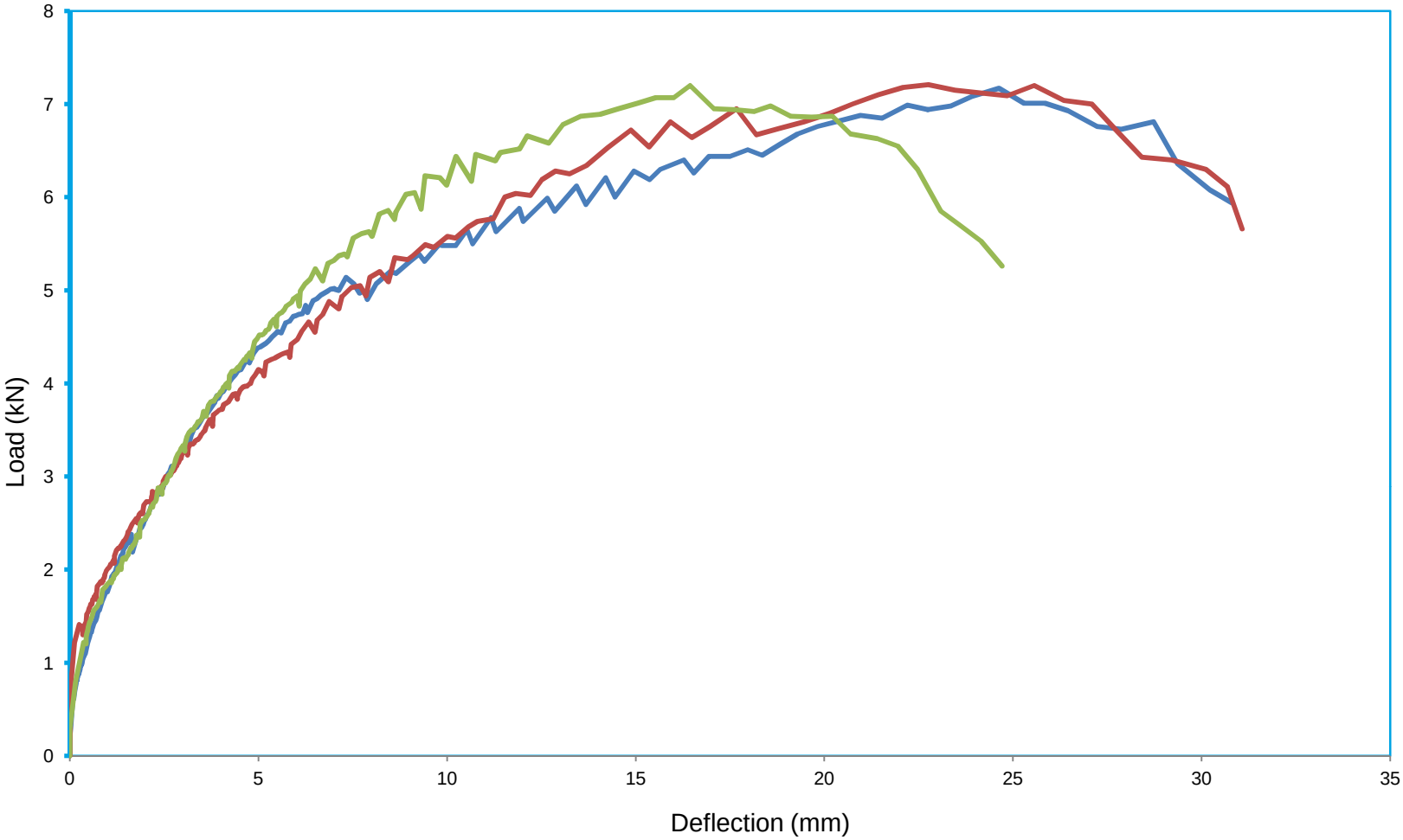

Chart 2 - Load-Deflection Curve for Racking Tests on 9 mm Magply Sheathing Boards with 150/300 mm Nailings with 5 kN Top Load

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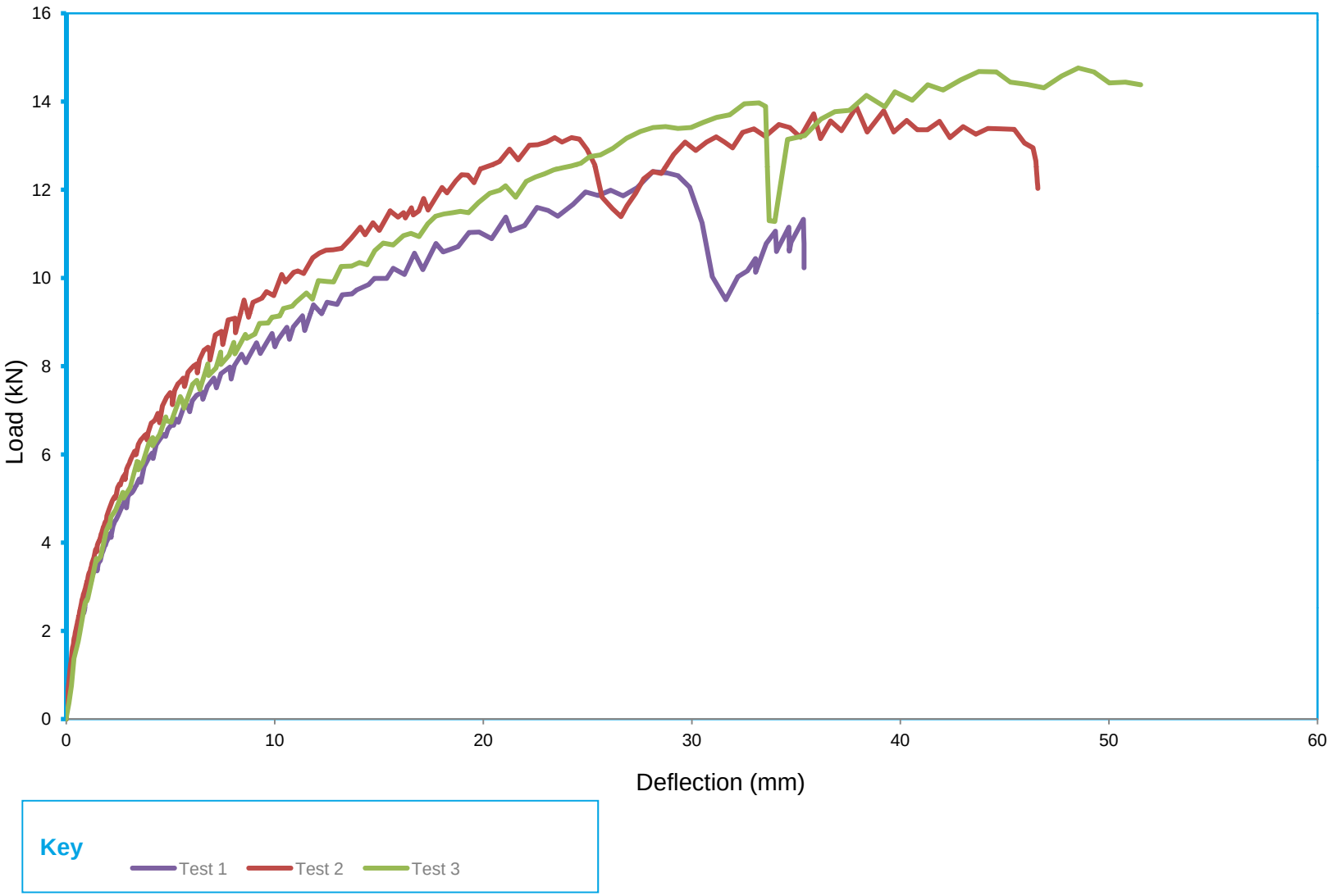

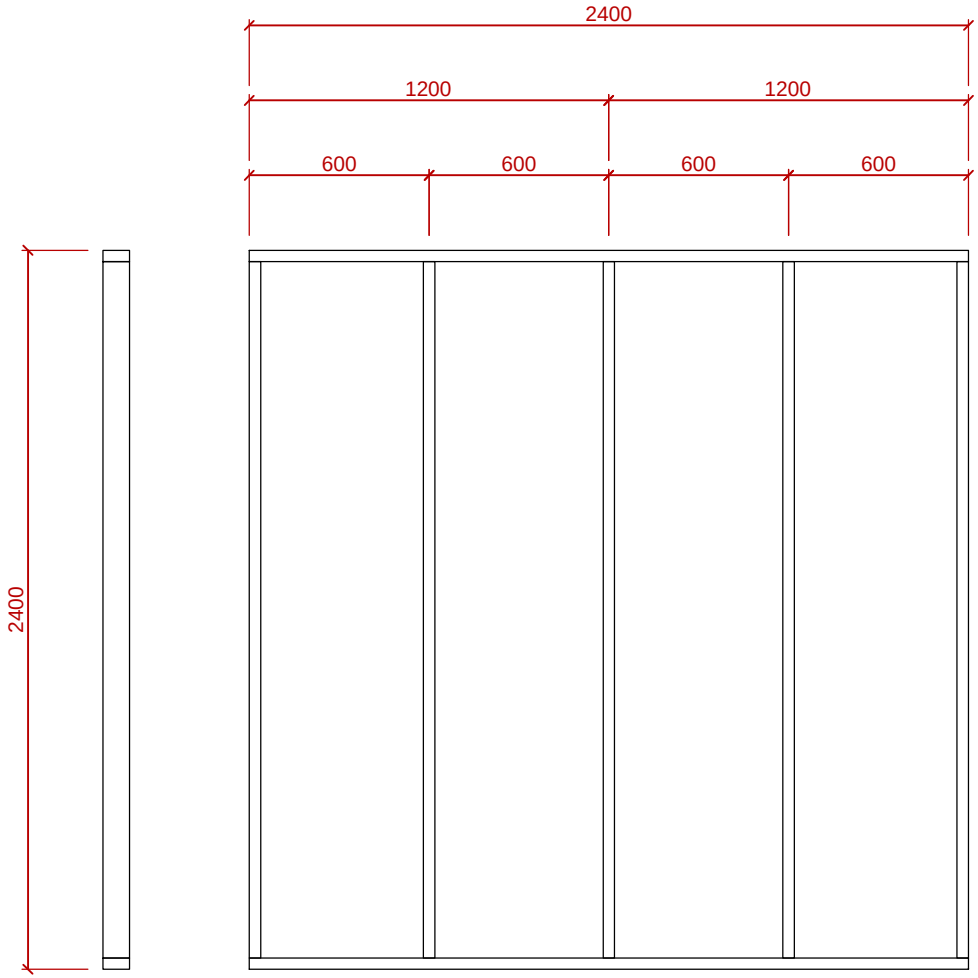

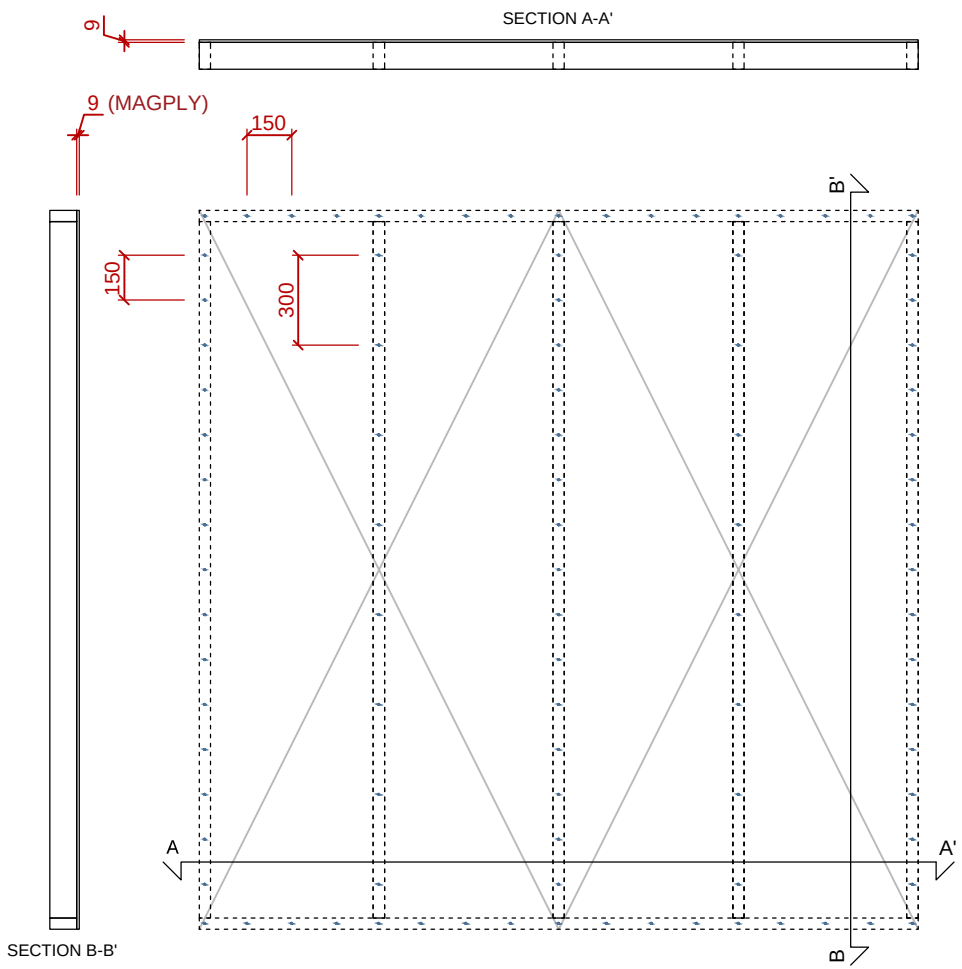

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Figure 1	Not to scale	25/09/2015	DE ZUANI V.

TITLE:
Details and Dimensions for Racking Panels

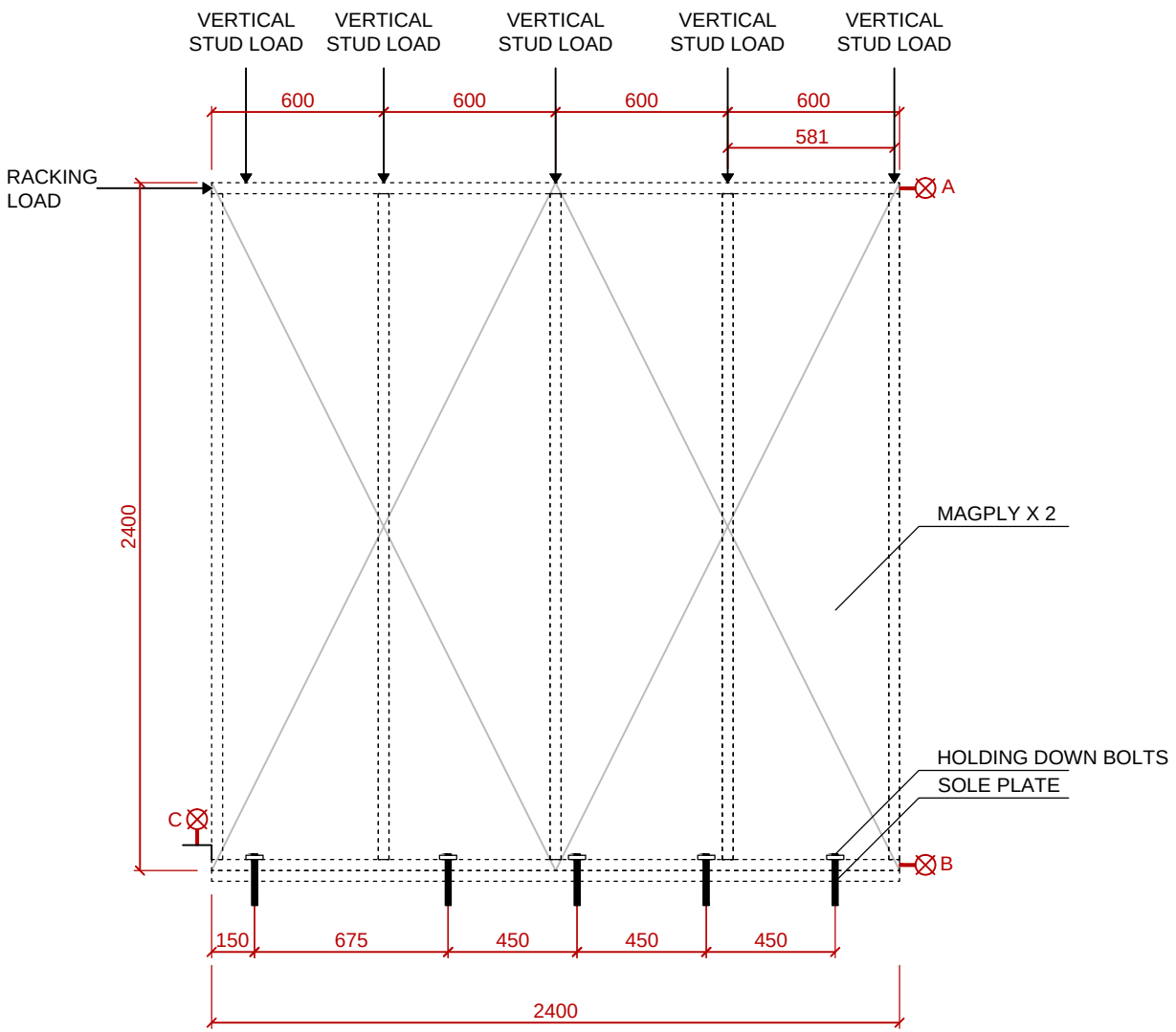

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Figure 2	Not to scale	25/09/2015	DE ZUANI V.

TITLE:
Racking Test Set up