Technical Report

Title: Wind resistance testing of Shadow Line+ cladding incorporating Envello Décor

Report No: N950-23-18585

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Title: Wind resistance testing of Shadow Line+ cladding incorporating Envello Décor.

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(confidential) 1 copy to project file

UKAS TESTING
0057

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1 INTRODUCTION

This report describes tests carried out at VINCI Technology Centre UK Limited at the request of Millboard.

The test sample consisted of a sample of cladding system manufactured by Millboard.

The tests were carried out in October 2023 and were to determine the wind resistance of the test sample. The test methods were in accordance with the CWCT Standard Test Methods for building envelopes, 2005, for:

Wind resistance – serviceability, cyclic & safety.

The testing was carried out in accordance with Technology Centre Method Statement C9644/MS rev 0.

This test report relates only to the actual sample as tested and described herein.

The results are valid only for sample(s) tested and the conditions under which the tests were conducted.

VINCI Technology Centre UK Limited is accredited to ISO/IEC 17025:2017 by the United Kingdom Accreditation Service as UKAS Testing Laboratory No. 0057 for a schedule of tests. Tests listed above and marked with an asterisk are not on our schedule.

VINCI Technology Centre UK Limited is Approved Body No. 1766.

VINCI Technology Centre UK Limited is certified by BSI for:

- ISO 9001 Quality Management System,
- ISO 14001 Environmental Management System,
- ISO 45001 Occupational Health and Safety Management System.

2 SUMMARY AND CLASSIFICATION OF TEST RESULTS

The following summarises the results of the tests carried out. For full details refer to Section 6.

2.1 SUMMARY OF TEST RESULTS

TABLE 1

Date	Test number	Test description	Result
19 October 2023	1	Wind resistance – serviceability	Pass
19 October 2023	2	Wind resistance – cycling loading	Pass
11 November 2023	3	Wind resistance – safety	Pass

2.2 CLASSIFICATION

TABLE 2

Test	Standard	Classification / Declared value
Wind resistance	CWCT / BS EN 13116	2155/-2650 pascals serviceability 3233/-3975 pascals safety

3 DESCRIPTION OF TEST SAMPLE

3.1 GENERAL ARRANGEMENT

The sample was as shown in the drawings and the photograph below and measured 3.0 m x 3.0 m.

The boards were fitted in the vertical orientation, fixed to timber battens with an example window inserted into the centre of the construction. In between every cladding board was an Envello Décor decorative strip, with both 16 & 32mm width used across the panel. The battens were set at 400mm centres max, with battens fully lining the window opening.

The Envello Décor strips were fixed to the battens with 30mm Envello Board fixings through the fixing flange for half of the construction, the other half of the panel the Décor strips were nailed onto the battens with 25mm ring shank nails. Where the cladding board tongue was taken off (around the window or at the edges) the boards were fixed to the battens with 16g brad nails.

The window reveal was lined with reveal boards, these were fixed to the timber battens with 16g brad nails.

PHOTO 105829

TEST SAMPLE ELEVATION

3.2 CONTROLLED DISMANTLING

During the dismantling of the sample no discrepancies from the drawings or damage to the support frame were found.

PHOTO 090315

PLANKS REMOVED FROM SUPPORT FRAME

PHOTO 090321

PLANKS REMOVED FROM SUPPORT FRAME

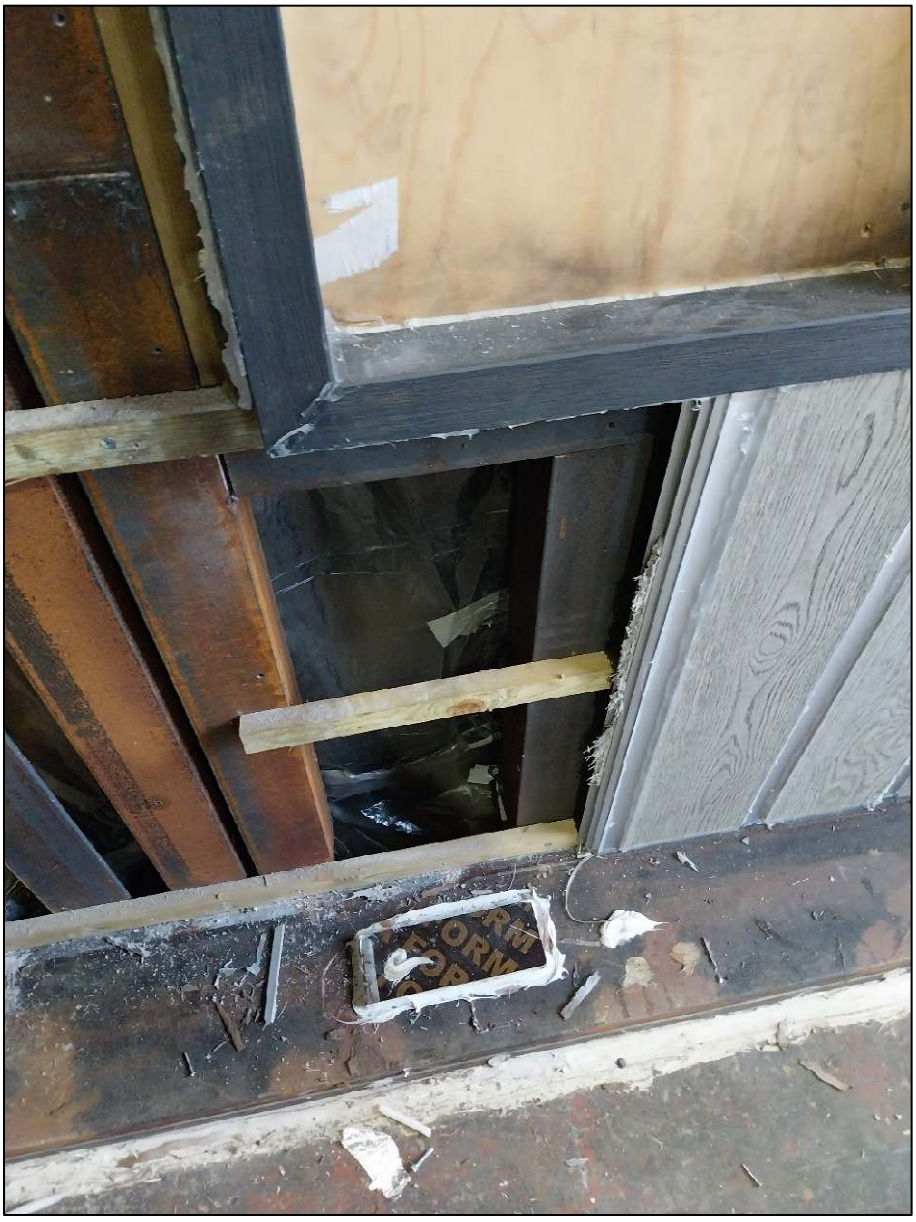

PHOTO 090328

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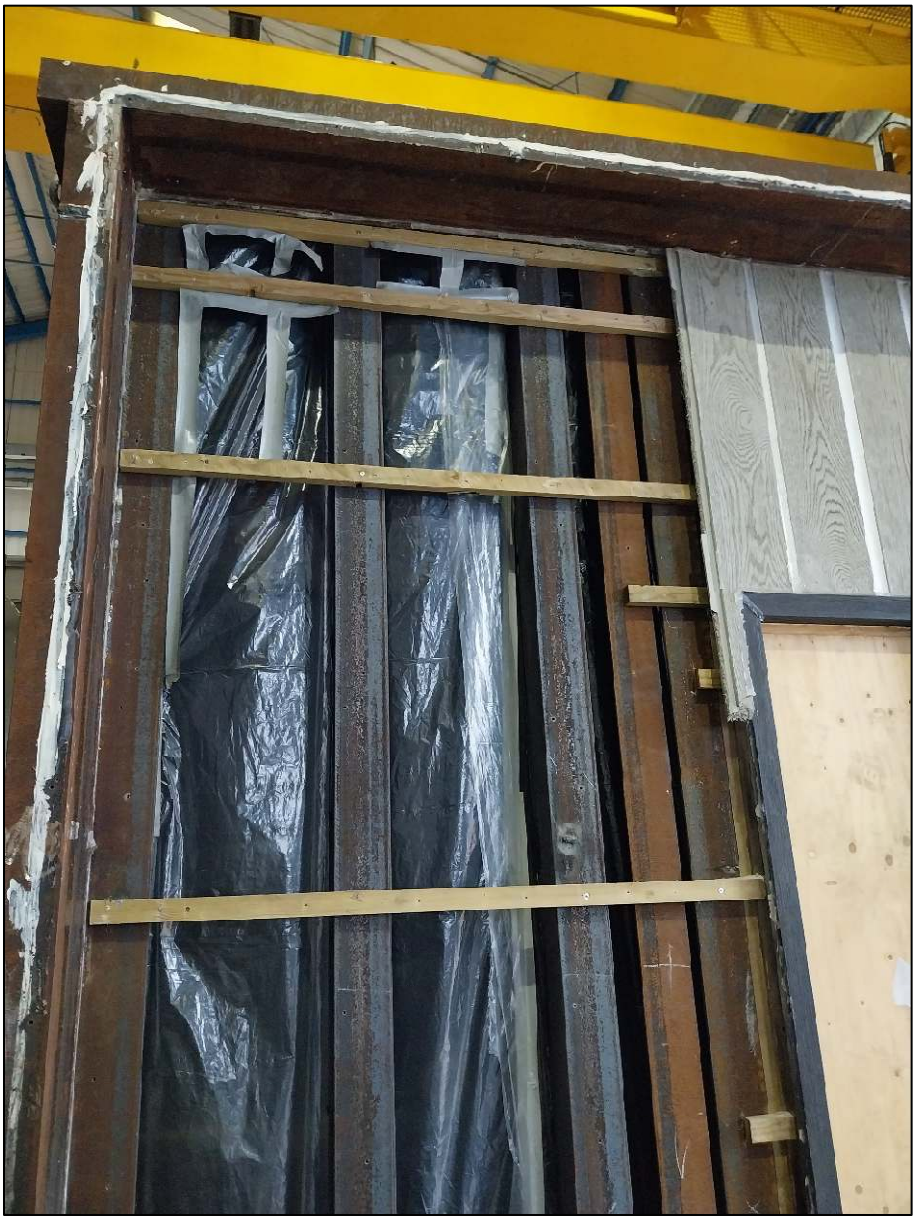

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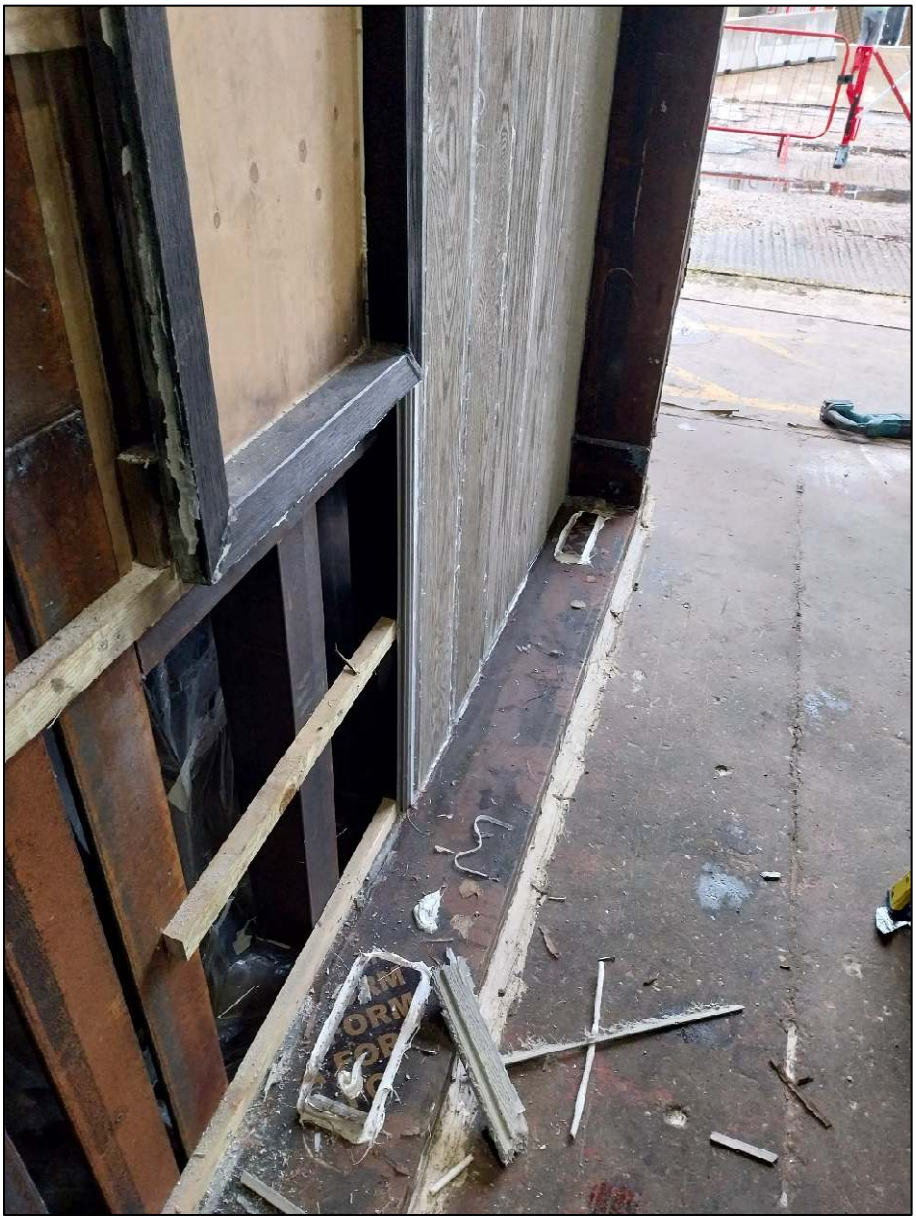


PHOTO 091118

PLANKS REMOVED FROM SUPPORT FRAME

PHOTO 091125

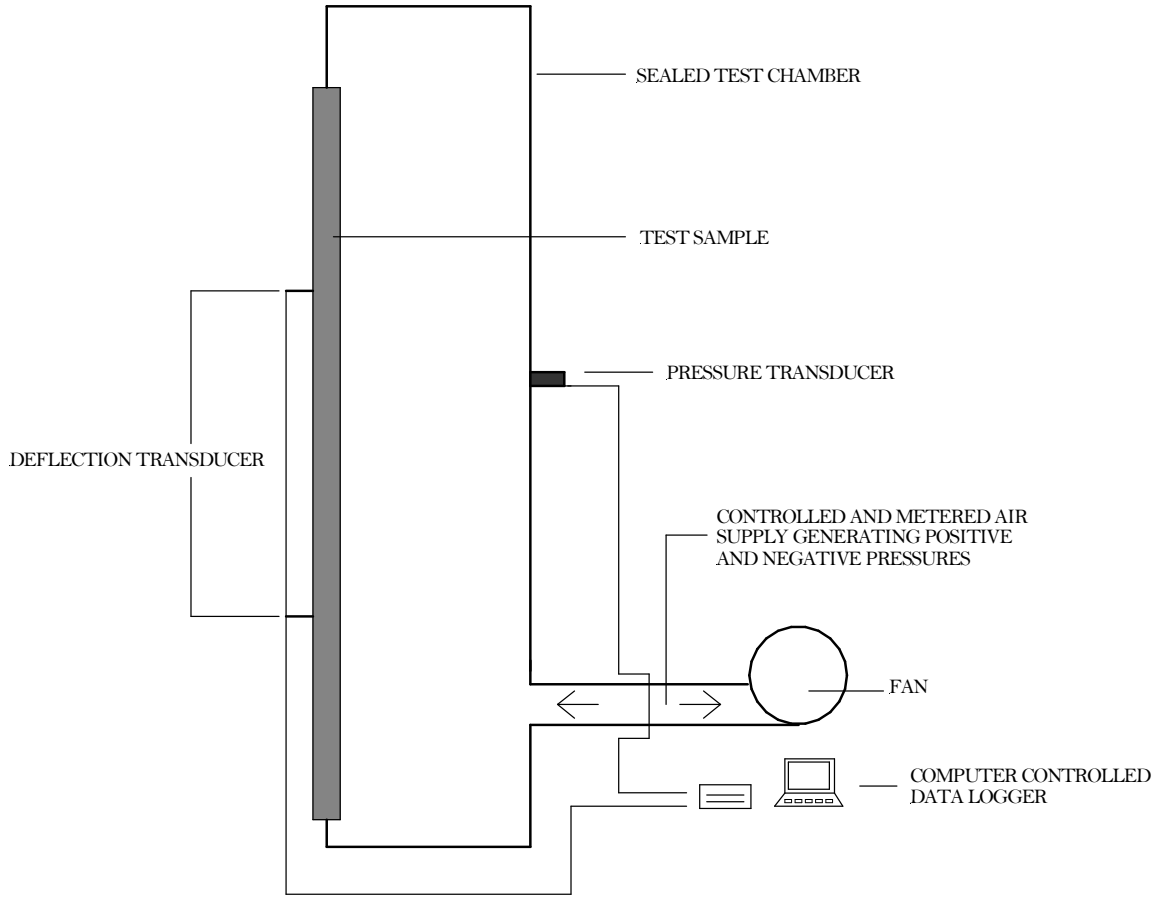
PLANKS REMOVED FROM SUPPORT FRAME

4 TEST RIG GENERAL ARRANGEMENT

The test sample was mounted on a rigid test rig with support steelwork designed to simulate the on-site/project conditions. The test rig comprised a well sealed chamber, fabricated from steel and plywood. A door was provided to allow access to the chamber. Representatives of Millboard installed the sample on the test rig. See Figure 1.

FIGURE 1

TEST RIG SCHEMATIC ARRANGEMENT



SECTION THROUGH TEST RIG

5 TEST SEQUENCE

The test sequence was as follows:

(1) Wind resistance – serviceability

(2) Wind resistance – cycling loading

(3) Impact resistance - safety

6 WIND RESISTANCE TESTING

6.1 INSTRUMENTATION

6.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

6.1.2 Deflection

Dial gauges were used to measure the deflection of the sample to an accuracy of 0.1 mm. The gauges were set normal to the sample. The gauges were located at the positions shown in Figure 2.

6.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air temperatures to within 1°C.

6.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

6.2 FAN

The air supply system comprised a variable speed centrifugal fan and associated ducting and control valves to create positive and negative static pressure differentials. The fan provided essentially constant air flow at the fixed pressure for the period required by the tests and was capable of pressurising at a rate of approximately 600 pascals in one second.

6.3 PROCEDURE

6.3.1 Wind Resistance – serviceability

Three positive pressure differential pulses of 1078 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 2155 pascals to 0. The pressure was increased in four equal increments each maintained for 15 ±5 seconds. Displacement readings were taken at each increment. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded.

Three negative pressure differential pulses of 1325 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one negative pressure differential pulse from 0 to -2650 pascals to 0. The pressure was increased in four equal increments each maintained for 15 ±5 seconds.

Displacement readings were taken at each increment. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded.

6.3.2 Wind Resistance – cyclic

The following cyclic load tests were carried out on the sample.

No of cycles	Applied pressure (pascals)
1	0.9 x WP = +1940 / -2385
960	0.4 x WP = +862 / -1060
60	0.6 x WP = +1293 / -1590
240	0.5 x WP = +1078 / -1325
5	0.8 x WP = +1724 / -2120
14	0.7 x WP = +1509 / -1855

Where WP = design wind load

The sequence above was repeated for a total of five times and then a single pulse of Wp (+2155 / -2650 pascals) was applied.

The frequency of oscillation was seven seconds between loading, with loading applied in a sinusoidal manner.

Any damage or functional defects were recorded.

6.3.3 Wind Resistance – safety

Three positive pressure differential pulses of 1078 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 3233 pascals to 0. The pressure was increased as rapidly as possible but not in less than 1 second and maintained for 15 ±5 seconds. Displacement readings were taken at peak pressure. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded.

Three negative pressure differential pulses of -1325 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

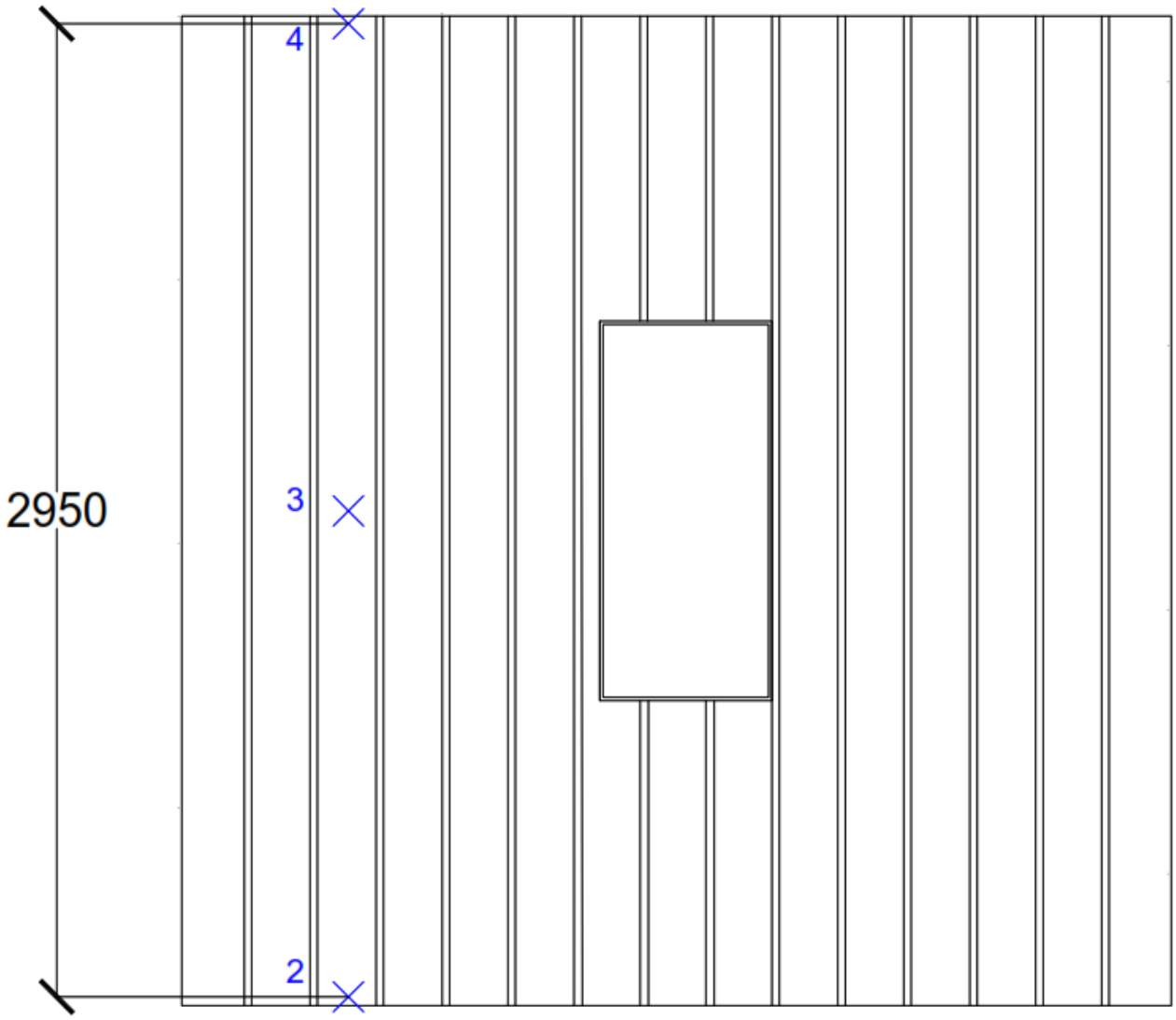
The sample was subjected to one negative pressure differential pulse from 0 to -3975 pascals to 0. The pressure was increased as rapidly as possible but not in less than 1 second and maintained for 15 ±5 seconds. Displacement readings were taken at peak pressure. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded.

FIGURE 2

DEFLECTION GAUGE LOCATIONS

External View



6.4 PASS/FAIL CRITERIA

6.4.1 Calculation of permissible deflection

Serviceability Test TABLE 4

Gauge number	Member	Span (L) (mm)	Permissible deflection (mm)	Permissible residual deformation
3	Board	2950	L/200 = 14.8	BS EN 13116: 5% of measured deflection CWCT: 1 mm

Safety Test TABLE 5

Gauge number	Member	Span (L) (mm)	Permissible deflection (mm)	Permissible residual deformation
3	Board	2950	n/a	L/500 = 5.9 mm

6.5 RESULTS

Test 1 (serviceability) Date: 19 October 2023

The deflections measured during the wind resistance test, at the positions shown in Figure 2, are shown in Tables 3 and 4.

Summary:

Serviceability Test TABLE 6

Gauge number	Member	Pressure differential (Pa)	Measured deflection (mm)	Residual deformation (mm)
3	Board	2153 -2642	2.1 -3.8	0.0 0.0

No damage to the test sample was observed.

Ambient temperature = 18 °C
Chamber temperature = 18 °C

Test 2 (cyclic) Date: 19 October 2023

No damage to the test sample was observed.

Ambient temperature = 18 °C
Chamber temperature = 18 °C

Test 3 (safety) Date: 11 November 2023

The deflections measured during the structural safety test, at the positions shown in Figure 2, are shown in Table 5.

Summary

Safety Test TABLE 7

Gauge number	Member	Pressure differential (Pa)	Measured deflection (mm)	Residual deformation (mm)
3	Board	3235 -3974	3.6 -6.7	0.0 -0.3

No damage to the sample was observed.

Ambient temperature = 2 °C
Chamber temperature = 2 °C

TABLE 4

WIND RESISTANCE – POSITIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	540	**1078**	**1625**	**2153**	**Residual**
2	0.1	0.1	0.2	0.3	0.0
3	0.6	1.2	1.9	2.4	0.0
4	0.0	0.2	0.4	0.5	0.0
3 *	0.6	1.1	1.6	2.1	0.0

* Mid-span reading adjusted between end support readings

TABLE 5

WIND RESISTANCE – NEGATIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	-667	**-1315**	**-1978**	**-2642**	**Residual**
2	-0.1	-0.3	-0.5	-0.8	0.0
3	-0.9	-2.0	-3.3	-4.7	-0.1
4	-0.1	-0.4	-0.7	-1.0	-0.1
3 *	-0.8	-1.6	-2.7	-3.8	0.0

* Mid-span reading adjusted between end support readings

TABLE 6

WIND RESISTANCE - **SAFETY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)			
	3235	Residual	-3974	Residual
2	0.5	0.0	-1.3	-0.1
3	4.0	0.0	-7.7	-0.4
4	0.2	0.0	-0.8	-0.0
3 *	3.6	0.0	-6.7	-0.3

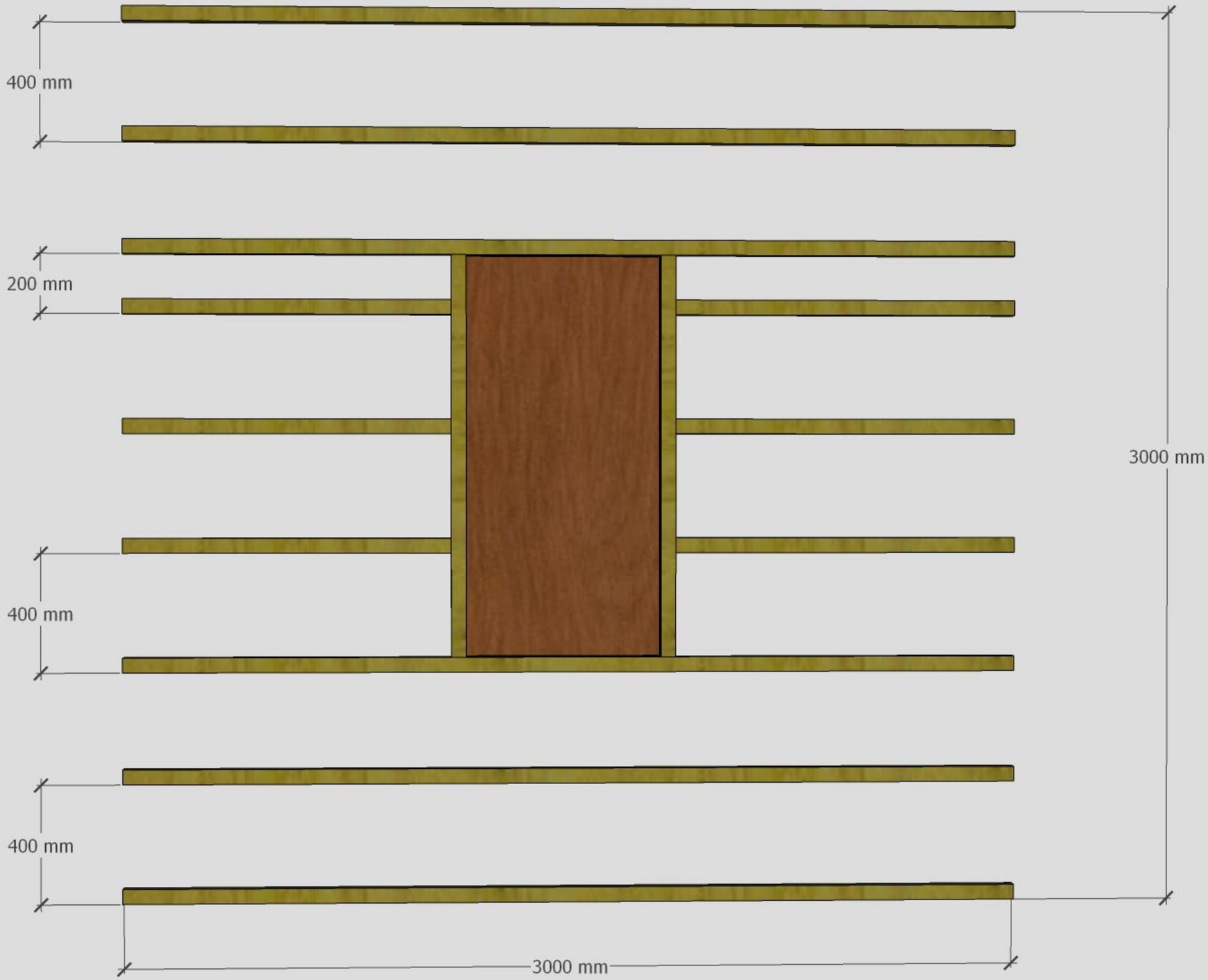
* Mid-span reading adjusted between end support readings

7 APPENDIX - DRAWINGS

The following 2 unnumbered pages are copies of millboard drawings of the test sample.

- Wind test Panel frame
- Wind test Panel 2

END OF REPORT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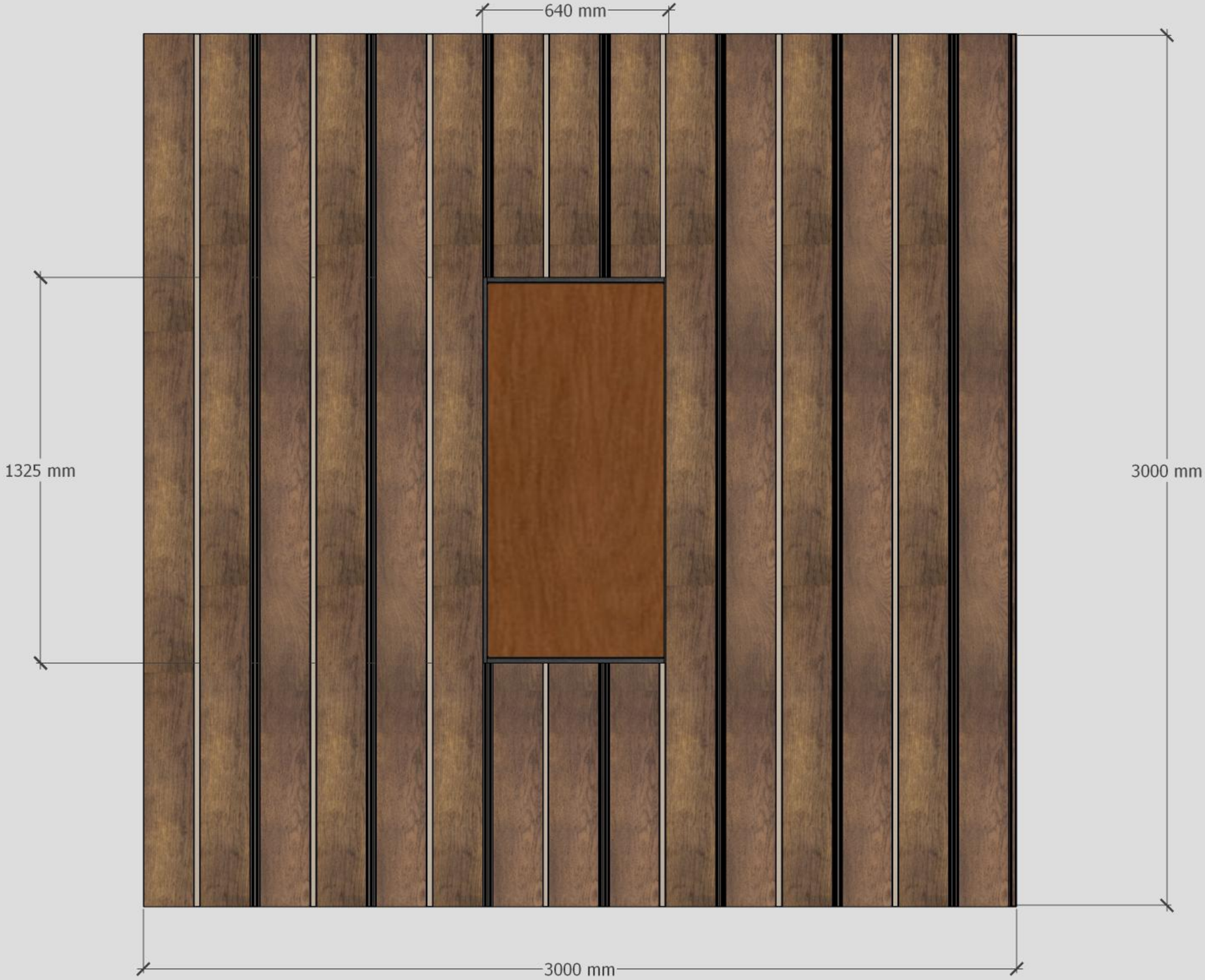
400 mm
400 mm
3000 mm
3000 mm


640 mm
1325 mm
3000 mm
3000 mm

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