

TECHNICAL REPORT



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Our Ref.: TREL30173

Date: 11th September 2009

Date delivered: 8th September 2009

Date of tests: 9th September 2009

For the attention of Mr Tony Jones

SAMPLE(S) FOR TEST :

FUSION® Domestic Stairs- Glass Panel Infill

TEST REQUIREMENTS :

BS 6180: 1999: Barriers in and about buildings – Code of practice
- General Contract use – Clauses 6.4.1

RESULT :

PASS

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FIRA International Limited

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INTRODUCTION

As part of the BM TRADA Certification Ltd Balustrade Product Conformity Scheme, FIRA was commissioned to undertake structural testing of FUSION® Domestic Stairs – Glass Panel Infill in accordance with the requirements of the following documents:

BS 6180: 1999: Barriers in and about buildings – Code of practice

BS 6399: Part 1: 1996: Loading for buildings - Code of practice for dead and imposed loads

BS 5268: Part 2: 2002: Structural use of timber – Code of practice for permissible stress design, materials and workmanship

The intention of the testing was to assess whether the products were structurally suitable for use in commercial arenas. Their failure mode and critical failure load were to be established in order to assess and improve upon future designs with the outcome that the developed design could be included in the BM TRADA Certification Ltd Balustrade Product Conformity Scheme.



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TEST SPECIMEN(S)

FUSION® Domestic Stairs- Glass Panel Infill

Description of Specimen Fusion domestic system with 4 x toughened glass infill panels fixed to the hand and base rail using zinc-alloy brackets.

HORIZONTAL unit set to a height of 900mm and 2,4m handrail length to centre of newels.

Tested to 0.36kN/m

System	FUSION® Domestic interior balustrade, horizontal with toughened glass infill panels
Timber Species	Pine <i>Pinus Syvestris</i>
Description of test unit	<i>See Attached Diagram</i>
Handrail 01-0000-495-E0807 RHR2400PF	Pine Round Handrail
Handrail length	2400mm <i>See Attached Diagram</i>
Glass Panel Infill 01-0000-826-0309 MMGPL1	Glass panel 757mm x 200mm x 6mm
Top Newel Dimensions 01-0000-496-0807 RHR750PF	54mm x 750mm
Newel Base Dimensions 01-0000-061-D0804 NB700P	82mm x 700mm
Base rail 01-0000-913-A0803 SBR2400PF	54mm x 27mm
Base rail Length	2400mm <i>See Attached Diagram</i>
String/Joist Dimensions	220mm x 28mm x 2482mm
Connectors Used 01-0000-880-D1004 01-0000-821-B0609 01-0000-875-A0203 01-0000-822-B0609 01-0000-829-0609 01-0000-824-A0609	Zinc Alloy (Zamak 3) Landing Connector (mmlcs) Newel Base Connector (mmncs) Triangular Base (mmgb1) Glass Bracket Clamp - back (mmgb2) Glass bracket clamp – Front (mmgb3) Glass Bracket Cover Cap (MMGB4)
Fixings Used	1.5mm EPDM rubber gasket 3.5mm x 38mm, flat head, csk,bzp,hardened screw 4.2mm x 25mm, flat head, stainless steel screw 4.2mm x 25mm, pan head, stainless steel screw 4.2 x 13mm, flat head, csk, socket head screw Nylon sleeve – 12mm x 10mm x 6mm

Product descriptions produced by FIRA International Ltd give basic Construction, Material and Dimensional information and are not intended to represent a complete product specification. Overall product dimensions will be recorded accurately. Where variations in material thickness occur, dimensions will be taken as standard thickness.



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TEST PROCEDURE

In- fill strength

A uniformly distributed load is applied to the handrail using calibrated weights and load bags laid on top of a foam sheet, which rests on the in-fill. The load is maintained for a period of 15 minutes, at the end of which the balustrade is inspected for structural damage. Experience has shown that if the in- fill can sustain the load when it is initially applied, then unless there is visual movement or lots of cracking noises at the fixings it not necessary to hold the load for 15 minutes.

TEST RESULTS

BS 6180: 1999, Clause 6.4.1 Balustrade horizontal deflection test

Item: FUSION® Domestic Stairs- Glass Panel Infill
Test Level: Domestic Applications
Initial Inspection: No apparent faults.

Load Table

	Domestic Level	DL x Q-Mark Safety Factor
UDL to In-fill	0.5kN/m ²	
UDL² Required	0.81kN	
UDL² Achieved	81kg	

Results Table

TEST	TEST REQUIREMENT		RESULT- Commercial Level
In-fill Strength	Design Load	Initial Loading	PASS



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CONCLUSION

When tested the FUSION® Domestic Stairs- Glass Panel Infill supplied by Richard Burbidge Ltd satisfied the selected combined rules of BS 6180: 1999: Barriers in and about buildings and BS 5268: Part 2: 2002: Structural use of timber – Code of practice for permissible stress design, materials and workmanship.

The Richard Burbidge FUSION® Domestic Stairs- Glass Panel Infill is therefore considered to be suitable for domestic applications when used in spans of 2400mm between the centres of newel posts.

NOTE(S)

A, B, C3 and E are the full range of applications for which the products are suitable as specified by BS 6399: Part 1: 1996. For more information see ANNEX B.

Tested and reported by: R Odhavji

Approved by: Rishi Odhavji
Development Engineer - Testing Services



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Plate 1: FUSION® Domestic Stair Unit with Glass Panels Before Test



Plate 2: FUSION® Domestic Stair Unit with Glass Panels on Test

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FUSION® GLASS PANEL
2.4m HORIZONTAL TEST UNIT - REF
SB004

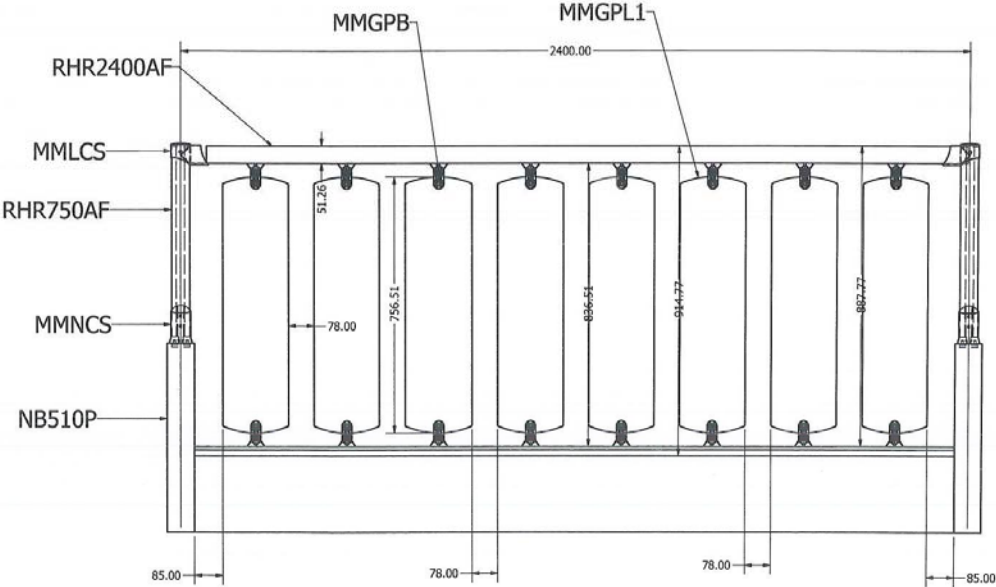


Plate 3: Drawing of FUSION® Domestic Stair Unit with Glass Panels



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ANNEX A

Test Requirements

Hand rail test

Stiffness test

Initially a stiffness test is to be carried out by applying the test loads for 15 minutes checking that the net deflection of the handrail at mid length between supports is less than 25mm. In accordance with BS 6180, the test loads were taken from BS 6399-1, table 4. These are based on the building-use categories, which are defined in Table 6.2.

The net handrail deflection is defined as:

$$d_{h,net} = d_{h,total} - d_{newel} - d_{stringer}, \text{ where}$$

$d_{h,total}$ = Total deflection at mid span of handrail in the direction of the load

d_{newel} = Deflection of the newel in the direction of the load. Deflection is to be measured at the crossing point between centreline of hand rail and centre line of newel.

$d_{stringer}$ = Deflection of mid span of the stringer in the direction of load. Deflection is to be measured at mid span of the stringer. This measurement is not applicable to balustrades with cut stringers (raised bottom rail).

For balustrades with glass components, the maximum deflection is L/65 or 25 mm which ever is the smaller. The definition of L should be sought in sections 8.3, 8.4 or 8.5 in BS 61800, as it is dependent on the actual design.

If the balustrade fails the deflection test, without experiencing permanent damage, it is suggested that a strength test be carried out.

Strength test

BS 6180 "Code of practice for barriers in and about buildings" only refers to a maximum deflection limit under design load. However for timber balustrades this limit has proven difficult to comply with although timber balustrades have been used safely for many years.

TRADA has taken a practical view on this and suggests that the overall deflection is of less importance providing the balustrade passes a strength test in accordance with Section 8 of BS 5268-2.

In accordance with this method the balustrade is to be loaded with an ultimate load of design load multiplied with the product of K_{73} and K_{85} of BS 5268-2. The balustrade is to sustain this load for 15minutes without failing (breaking).

As per guidance in BS 6180, the design loads have been taken from Table 4 in BS 6399-1.

TRADA suggests that loads on stairs can be considered "medium term", which means that the overall load safety factor ($K_{73} \times K_{85}$) will range from 1.79 (if five identical balustrades are tested) and 2.24 (if only one balustrade is tested).

The Q-mark scheme was set up when an earlier version of BS 5268-2 was governing. At that time the safety ranged between 2 (for five tests) and 2.5 (for one test). These are equivalent to the overall load safety factor ($K_{73} \times K_{85}$) for "long term" loads on the current version of BS 5268-2. For consistency these factors are still used for the Q-mark tests.

It is suggested that initially the "medium term" loads (given as "5268" loads in table 6.1 is applied for 15 minutes. If the rail passes, additional load to fulfil the Q-mark regulations is applied and the whole load is held for another 15 minutes.

If the balustrade fails to withstand the 15 minutes with "Q-mark" loading, but passes the "5268" load the client will not be able to have the balustrade Q-mark certified, but can receive a test report claiming compliance with combined rules of BS 6180 and 5268-2.

Spindle / infill tests

Individual spindles



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BS 6180 does not give a deflection limit for spindles, which means that a strength test is required unless calculations can prove that the spindles can withstand the design load given in BS 6399-1, Table 4. Clause 6.3.1 in BS 6180 allows the design load to be halved when the infill "consist of successive balusters".

As these tests are relatively "quick and easy" to do, it is suggested that a minimum of 5 balusters are tested, giving a safety factor of 1.79 for "5268" loads and 2.00 for Q-mark loads. The test loads to be applied are given in table 6.2 in Annex B. It should however be noted that the Q-mark scheme requires all spindles to be tested.



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ANNEX B

Table 6.2 Use of buildings or part buildings

Taken from BS 6399: Part 1: 1996: Loading for buildings - Code of practice for dead and imposed loads.

Building-Use category	Type of occupancy for part of the building or structure	Descriptive title
A	Domestic and residential activities	(i) All areas within or serving exclusively one single family dwelling including stairs, landings, etc. but excluding external balconies and edges of roofs (see C3 ix)
		(ii) Other residential, (but also see C)
B and E	Offices and work areas not included elsewhere including storage areas	(iii) Light access stairs and gangways not more than 600 mm wide (not applicable to stair rails)
		(iv) Light pedestrian traffic routes in industrial and storage buildings except designated escape routes
		(v) Areas not susceptible to overcrowding in office and industrial buildings also industrial and storage buildings except as given above
C	Areas where people may congregate	
C1/C2	Areas with tables or fixed seating	(vi) Areas having fixed seating within 530 mm of the barrier, balustrade or parapet
		(vii) Restaurants and bars
C3	Areas without obstacles for moving people and not susceptible to overcrowding	(viii) Stairs, landings, corridors, ramps
		(ix) External balconies and edges of roofs. Footways and pavements within building curtilage adjacent to basement/sunken areas
C5	Areas susceptible to overcrowding	(x) Footways or pavements less than 3 m wide adjacent to sunken areas
		(xi) Theatres, cinemas, discotheques, bars, auditoria, shopping malls, assembly areas, studio. Footways or pavements greater than 3 m wide adjacent to sunken areas
		(xii) Grandstands and stadia
D	Retail areas	(xiii) All retail areas including public areas of banks/building societies or betting shops. For areas where overcrowding may occur, see C5
F/G	Vehicular	(xiv) Pedestrian areas in car parks including stairs, landings, ramps, edges or internal floors, footways, edges of roofs
		(xv) Horizontal loads imposed by vehicles

