

TEST REPORT

Lucideon Reference: UK211035 (QT-62816/2/JB)/Ref. 1C

Project Title: Testing of Spigots Type 1822009 and 1822011B - Free Standing Glass Protective Barrier System to BS 6180

Client: FH Brundle
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Work Location: Lucideon UK



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1 INTRODUCTION

FH Brundle design and manufacture balustrades and barrier components to be used as architectural features in new and existing buildings. As part of their product development they required an extensive programme of testing to determine their product's performance in accordance with British and other European Standards.

2 SAMPLES AND TESTING

A range of free standing glass protective barriers were tested in accordance with BS 6180:2011 - Barriers In and About Buildings – Code of Practice. At the request of FH Brundle, the opportunity was taken to determine the deflections at a datum height of 1200 mm from the finished floor level. This was additional data and not required by the Standard.

An additional Standard used for testing was the Italian Standard UNI 10806:1999 Railings, Balustrades or Prefabricated Parapets - Determination of Mechanical Resistance to Distributed Static Loads.

Table 1 - List of Samples and Associated Test Numbers

Reference	Test	Sample	Standard
C	1	Spigots - Type 1822009 – 12 mm Toughened Glass Panel	BS 6180
	2	Spigots - Type 1822009 – 15 mm Toughened Glass Panel	BS 6180
	2a	Spigots - Type 1822009 – 15 mm Toughened Glass Panel	UNI 10806
	3	Spigots - Type 1822011B – 12 mm Toughened Glass Panel	BS 6180
	3a	Spigots - Type 1822011B – 12 mm Toughened Glass Panel	UNI 10806

3 TEST ARRANGEMENT

A concrete block of dimensions 2300 mm (L) x 900 mm (W) x 500 mm (H) was fastened to the laboratory strong-floor. The concrete was C35 with glass fibres and aggregate size of 20 mm.

Representatives from FH Brundle fitted the systems under test to the concrete block, ready for testing. Lucideon fitted the test equipment in place and conducted the testing.

Testing was sequentially conducted to Duplex Round Spigots (part number 1822009) and Duplex Black Square Spigots (part number 1822011B). Each design comprised of 2 Spigots. The pair of spigots were fitted to the top surface of the concrete block spaced 700 mm between centres.

Each different type and thickness of glass to be tested was fixed, in turn, into the spigots.

4 TEST METHOD

A hardwood spreader beam was placed at a distance of 1100 mm from the finished floor height to simulate a uniformly distributed line-load.

A reaction frame consisting of 2 No. steel stanchions and a steel cross-member was fastened to the laboratory strong-floor such that a ram could be clamped to the steel cross-member at the same height as the hardwood spreader.

A 5 kN calibrated load cell was attached to the hydraulic ram by way of a steel cage, to measure the load during testing.

Two calibrated Linear Voltage Displacement Transducers (LVDT's), to measure the deflection, were attached to the opposite side of the glass panel as the load was applied in the centre width of the panel at 1100 mm from the finished floor height. The LVDT's were positioned at 1100 mm and also 1200 mm from the finished floor height. The LVDT height of 1200 mm is not required by BS 6180, but does provide some useful information for the client.

For BS 6180 a load was steadily applied up to each loading increment or until a deflection of 25 mm was reached as highlighted within BS 6180. The load at the last increment was then recorded.

For the UNI 10806 (Italian) tests, the line load was increased to a value as directed by a representative of FH Brundle. This test involves applying the load to the desired value (typically 2 kNm^{-1}), followed by a dwell period of 15 minutes. The load is then removed, followed by a dwell period of 5 minutes. Deflection measurements are maintained throughout testing.

It should be noted that the result values in Table 2 and Table 3 are expressed as kN/m. Therefore, given that all glass barrier lengths were greater than 1000 mm wide, the kN reading from the load cell has been divided by a factor representing the length of the glass barrier (1.087), to obtain the kN/m value. Refer to the Client's Drawings TR10-003, TR10-004, Charts 1-4 and Plates 1-6.

5 RESULTS

Table 2 – BS 6180 Results - Refer to Parts List in Table 5

Type of Occupancy for Part of the Building	Examples of Specific Use	Horizontal Uniformly Distributed Line Load (kN/m)	Spigot 1822009		Spigot 1822011B
			12 mm Toughened Glass	15 mm Toughened	12 mm Toughened Glass
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	0.36	X	✓	✓
	(ii) other residential, i.e. houses of multiple occupancy and balconies, including Juliette balconies and edges of roofs in single family dwellings	0.74	X	X	X
Offices and work areas not included elsewhere, including storage areas	(iii) light access stairs and gangways not more than 600 mm wide	0.22	✓	✓	✓
	(iv) light pedestrian traffic routes in industrial and storage buildings except designated escape routes	0.36	X	✓	✓
	(v) areas not susceptible to overcrowding in office and institutional buildings, also industrial and storage buildings except as given above	0.74	X	X	X
Areas where people might congregate	(vi) areas having fixed seating within 530 mm of the barrier, balustrade or parapet	1.50	X	X	X
Areas with tables or fixed seating	(vii) restaurants and bars	1.50	X	X	X

Type of Occupancy for Part of the Building	Examples of Specific Use	Horizontal Uniformly Distributed Line Load (kN/m)	Spigot 1822009		Spigot 1822011B
			12 mm Toughened Glass	15 mm Toughened	12 mm Toughened Glass
Areas without obstacles for moving people and not susceptible to overcrowding	(viii) stairs, landings corridors ramps	0.74	X	X	X
	(ix) external balconies including Juliette balconies and edges of roofs; footways and pavements within building cartilage adjacent to basement/sunken areas	0.74	X	X	X
Areas susceptible to overcrowding	(x) footways or pavements less than 3 m wide adjacent to sunken areas	1.50	X	X	X
	(xi) theatres, cinemas, discotheques, bars, auditoria, shopping malls, assembly areas, studios; footways or pavements greater than 3 m wide adjacent to sunken areas	3.00	X	X	X
	(xii) grandstands and stadia	(Note A)	-	-	-
Retail areas	(xiii) all retail areas including public areas of banks/building societies or betting shops	1.50	X	X	X
Vehicular	(xiv) pedestrian areas in car parks, including stairs, landings, ramps, edges of internal floors, footways, edges of roofs	1.50	X	X	X
	(xv) horizontal loads imposed by vehicles	(Note B)	-	-	-

Note A) See requirements of the appropriate certifying authority.

Note B) See Annex A. (BS 6180:2011)

Table 3 – Results - Horizontal Line Load Applied at 1100 mm from the Finished Floor Height BS 6180

Test	1	2	3
Glass Type	12 mm Toughened Glass	15 mm Toughened Glass	12 mm Toughened Glass
Spigot Type	1822009	1822009	1822011B
Size of Glass (mm)	1087 (L) x 1200 (H)	1087 (L) x 1200 (H)	1087 (L) x 1200 (H)
Results of deflections at 1100 mm from the finished floor height.			
Deflection at 0.36 kN/m (mm)	X	20.19	21.00
Deflection at 0.74 kN/m (mm)	X	X	X
Load at 25 mm deflection (kN/m)	0.34	0.44	0.42
Results of deflections at 1200 mm from the finished floor height.			
Deflection at 0.36 kN/m (mm)	X	22.62	23.51
Deflection at 0.74 kN/m (mm)	X	X	X
Deflection at 25 mm* (mm)	28.10	27.97	28.04

Table 4 - Results - Horizontal Line Load Applied at 1100 mm from the Finished Floor Height – UNI 10806

Test	2a	3a
Glass Type	15 mm Toughened Glass	12 mm Toughened Glass
Load (kN/m)	0.88	0.78
Deflection at 1100 mm Height (mm)	50.33	49.94
Deflection at 1200 mm Height (mm)	55.76	55.64
Residual Deflection at 1100 mm Height (mm)	5.75	5.93
Residual Deflection at 1200 mm Height (mm)	6.29	6.52

Table 5 – Parts List

Test	Item	FH Brundle Part Number	Quantity (per test)
1,2 & 2a	Duplex Round Spigots	1822009	2
	M8 x 75 mm Concrete Screw	5002CCS875	8
	12 mm Toughened Glass Panel	18551212001087	1
	15 mm Toughened Glass Panel	18551512001087	1
3 & 3a	Duplex Black Square Spigot	1822011B	2
	M8 x 75 mm Concrete Screw	5002HCS8100	8
	12 mm Toughened Glass Panel	18551212001087	1

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

END OF REPORT

PLATES



Plate 1 – Test 1 – 12 m Toughened Glass – Load Application Side



Plate 2 – Test 1 – 12 mm Toughened Glass – Deflection Measurement Side



Plate 3 – Test 2 – Spigot Type 1822009

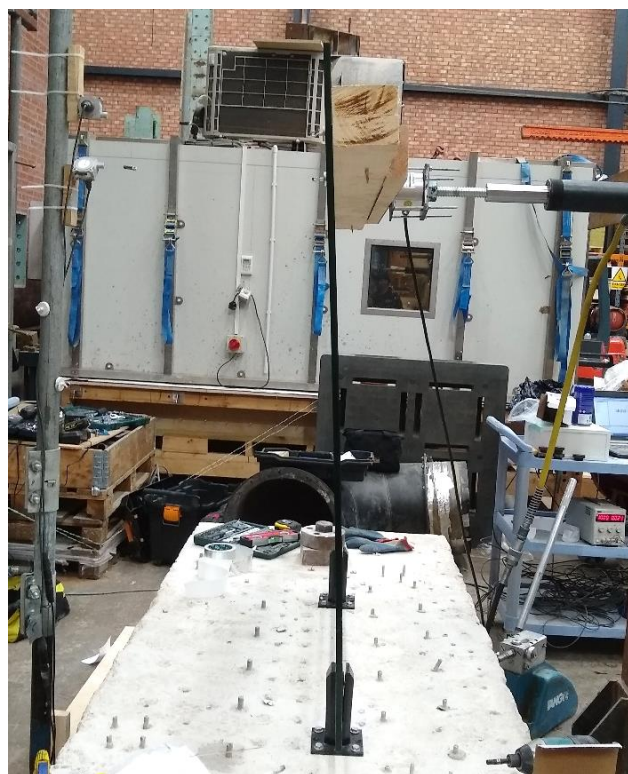


Plate 4 – Test 3a – 12 mm Toughened Glass – UNI 10806 Test

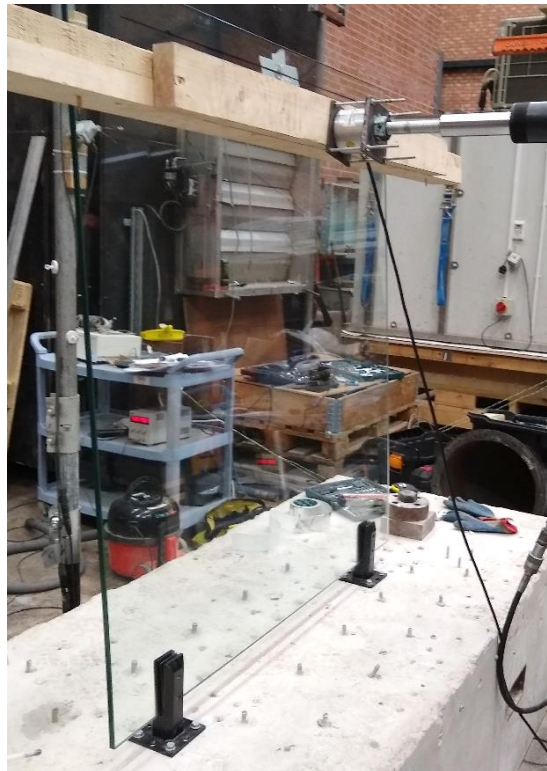


Plate 5 – Test 3a – 12 mm Toughened Glass – UNI 10806 Test – Load Application Side



Plate 6 – Test 3a – Spigot Type 1822011B

Chart 1 - Ref. 1C - Tests 1,2 & 3 - Spigots - Horizontal Line Load at 1100 mm Height
 - Deflection at 1100 mm Height - BS 6180

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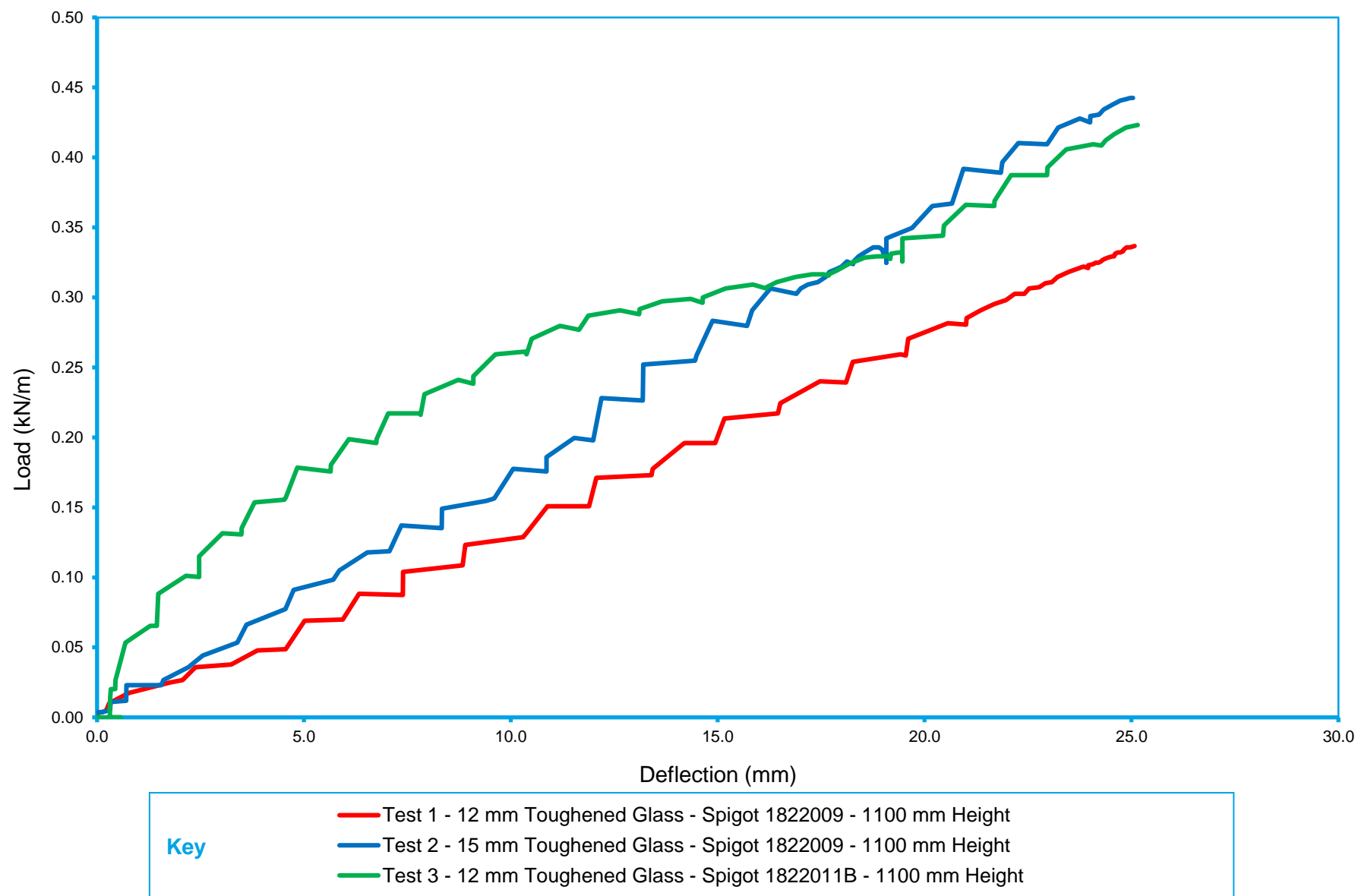
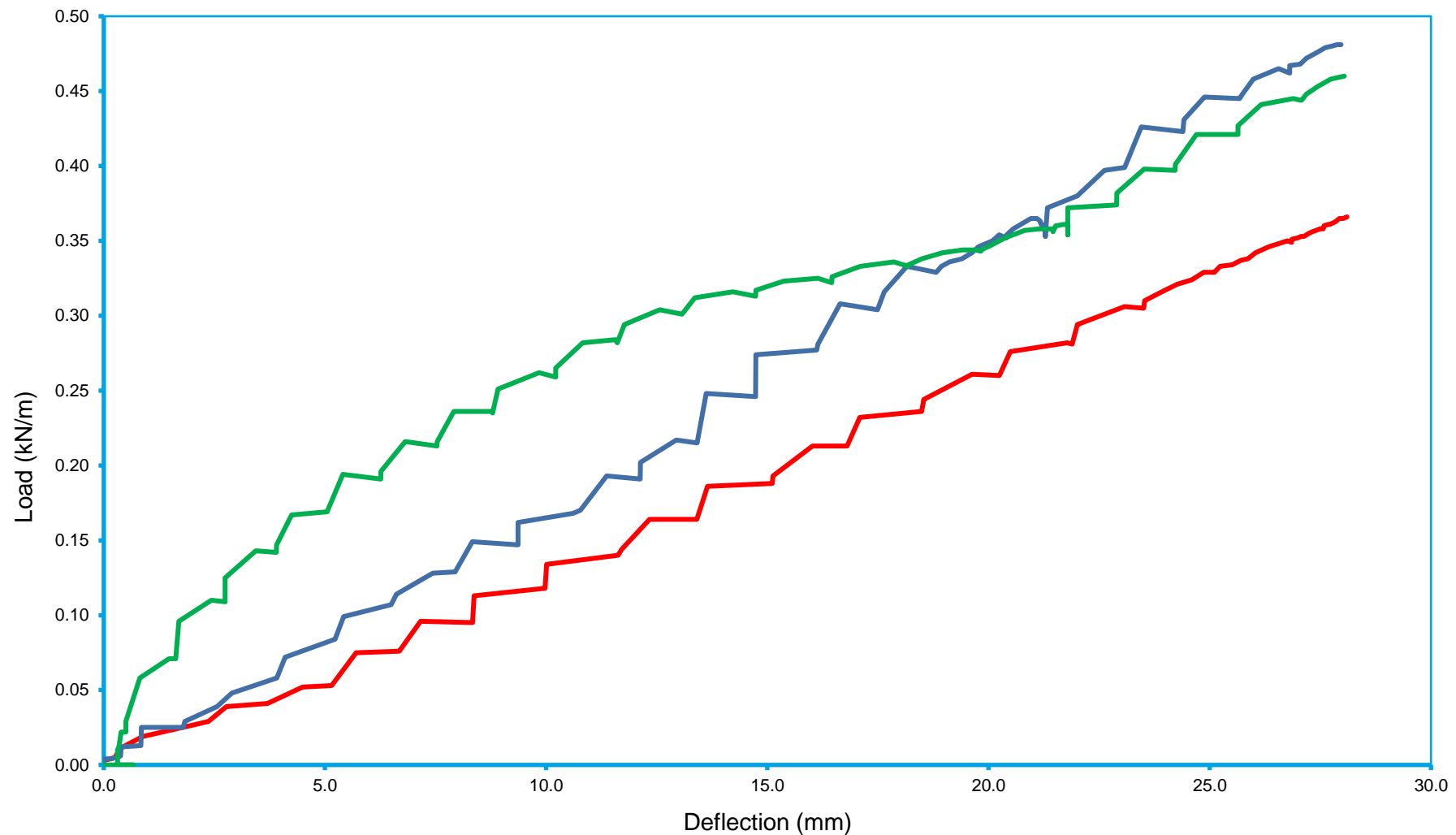


Chart 2 - Ref. 1C - Tests 1,2 & 3 - Spigots - Horizontal Line Load at 1100 mm Height
- Deflection at 1200 mm Height

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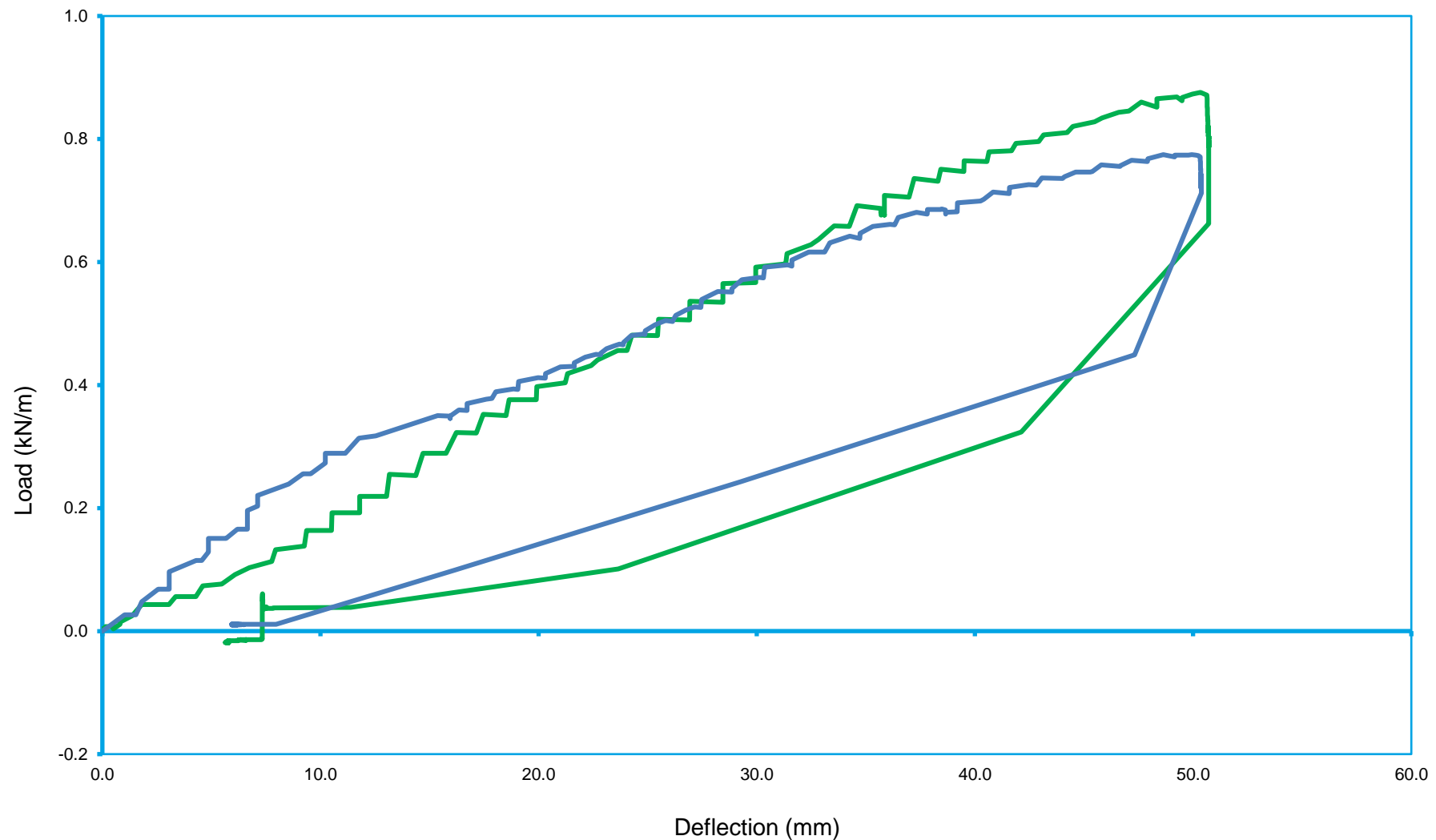


Key

- Test 1 - 12 mm Toughened Glass - Spigot 1822009 - 1200 mm Height
- Test 2 - 15 mm Toughened Glass - Spigot 1822009 - 1200 mm Height
- Test 3 - 12 mm Toughened Glass - Spigot 1822011B - 1200 mm Height

Chart 3 - Ref. 1C - Test 2a and 3a - Spigots - Horizontal Line Load at 1100 mm Height
- Deflection at 1100 mm Height - UNI 10806

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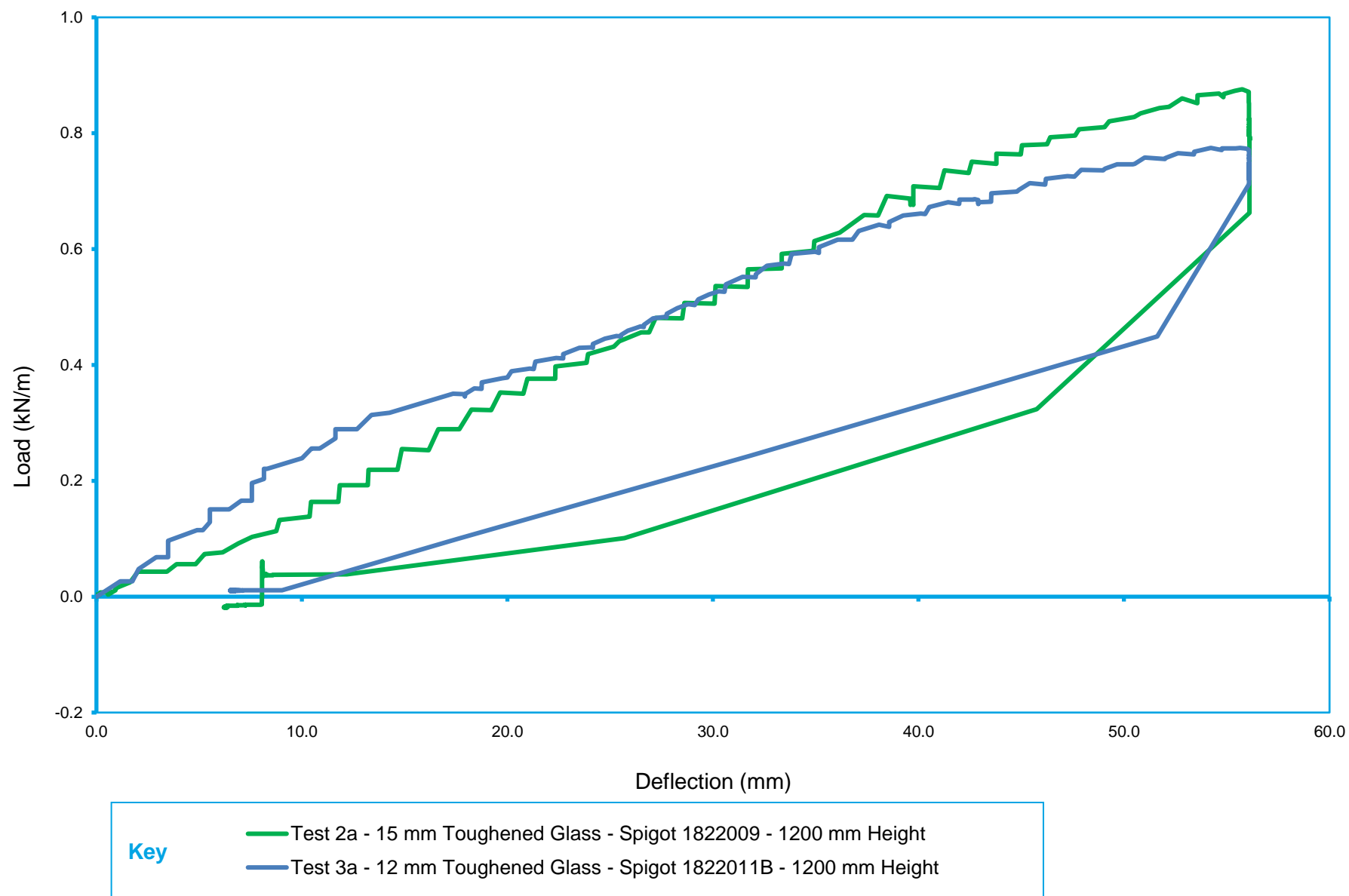


Key

- Test 2a - 15 mm Toughened Glass - Spigot 1822009 - 1100 mm Height
- Test 3a - 12 mm Toughened Glass - Spigot 1822011B - 1100 mm Height

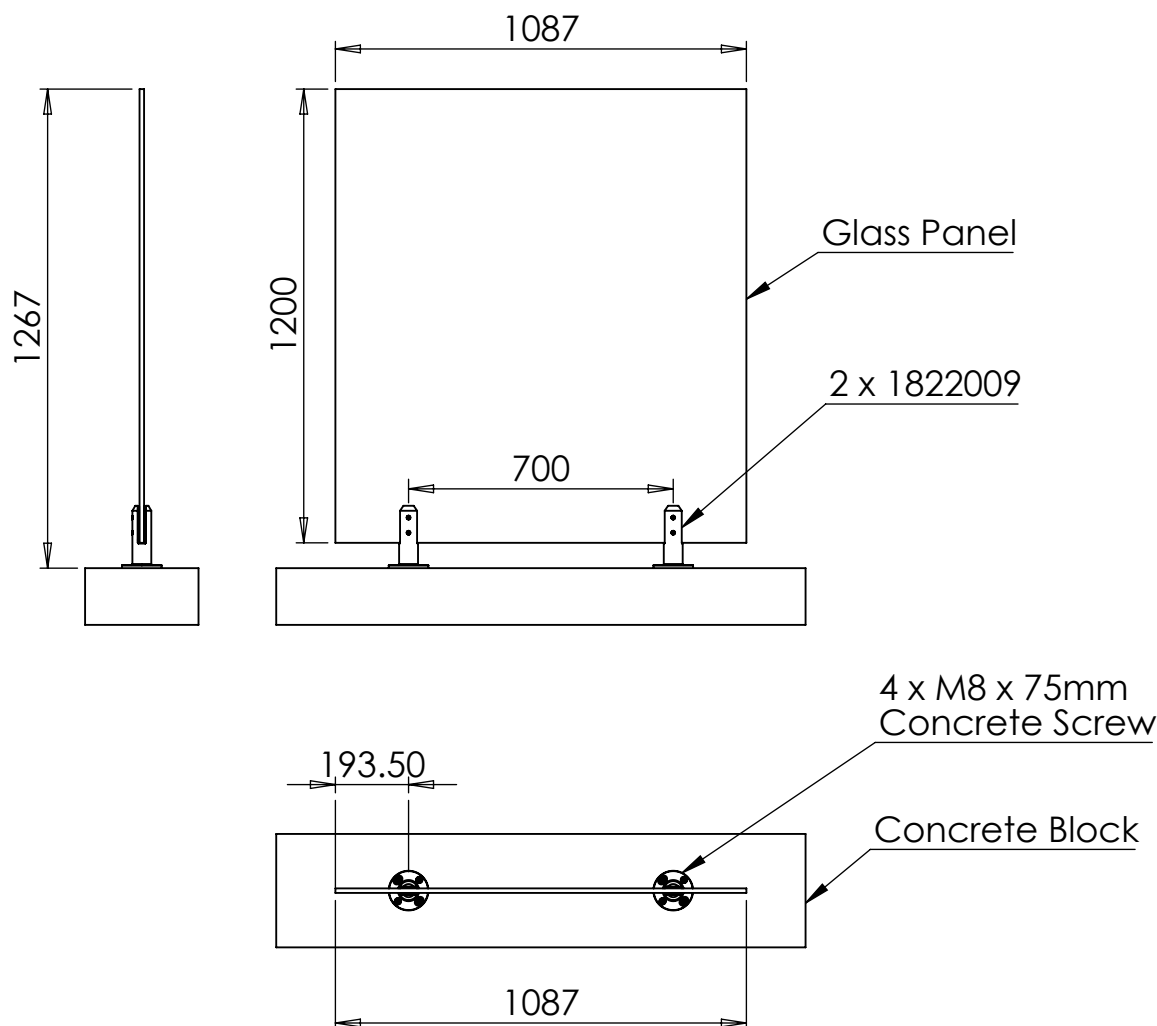
Chart 4 - Ref. 1C - Test 2a and 3a - Spigots - Horizontal Line Load at 1100 mm Height
 - Deflection at 1200 mm Height

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	NAME	DATE	REVISION
DRAWN	CH	21/04/2021	B
CHECKED			



Load Testing of Pro-Railing Duplex 2205 Round Spigot System, Which Comprises of Two Spigots With A Range of Glass Panels to BS EN 6180:2011 & UNI 10806:1999

Carry out load testing in accordance with BS 6180:2011 Barriers in and about buildings, and EC1-1991-1-1:2002 UK National Annex to Eurocode 1: Actions on structures – Part 1-1: General actions - Densities, self-weight, imposed loads for buildings.

Carry out load testing in accordance with UNI 10806:1999
 Prefabricated Railing Systems - Determination of the mechanical strength under static load.

These tests will allow FH Brundle Duplex 2205 Round Spigot system to be classified for use in accordance with the Code of Practice included within the standards.

Test In Accordance	Parts Required	Foundation Material	Glass Size & Type	Fixings	Notes
BS EN 6180:2011 UNI 10806:1999	2 x 1822009	C35 with glass fibres aggregate size 20mm slump 100	1200 x 1087mm 12mm Toughened	M8 x 75mm Concrete Screws	Spigots Spaced at 700mm Centres
BS EN 6180:2011 UNI 10806:1999	2 x 1822009	C35 with glass fibres aggregate size 20mm slump 100	1200 x 1087mm 15mm Toughened	M8 x 75mm Concrete Screws	Spigots Spaced at 700mm Centres

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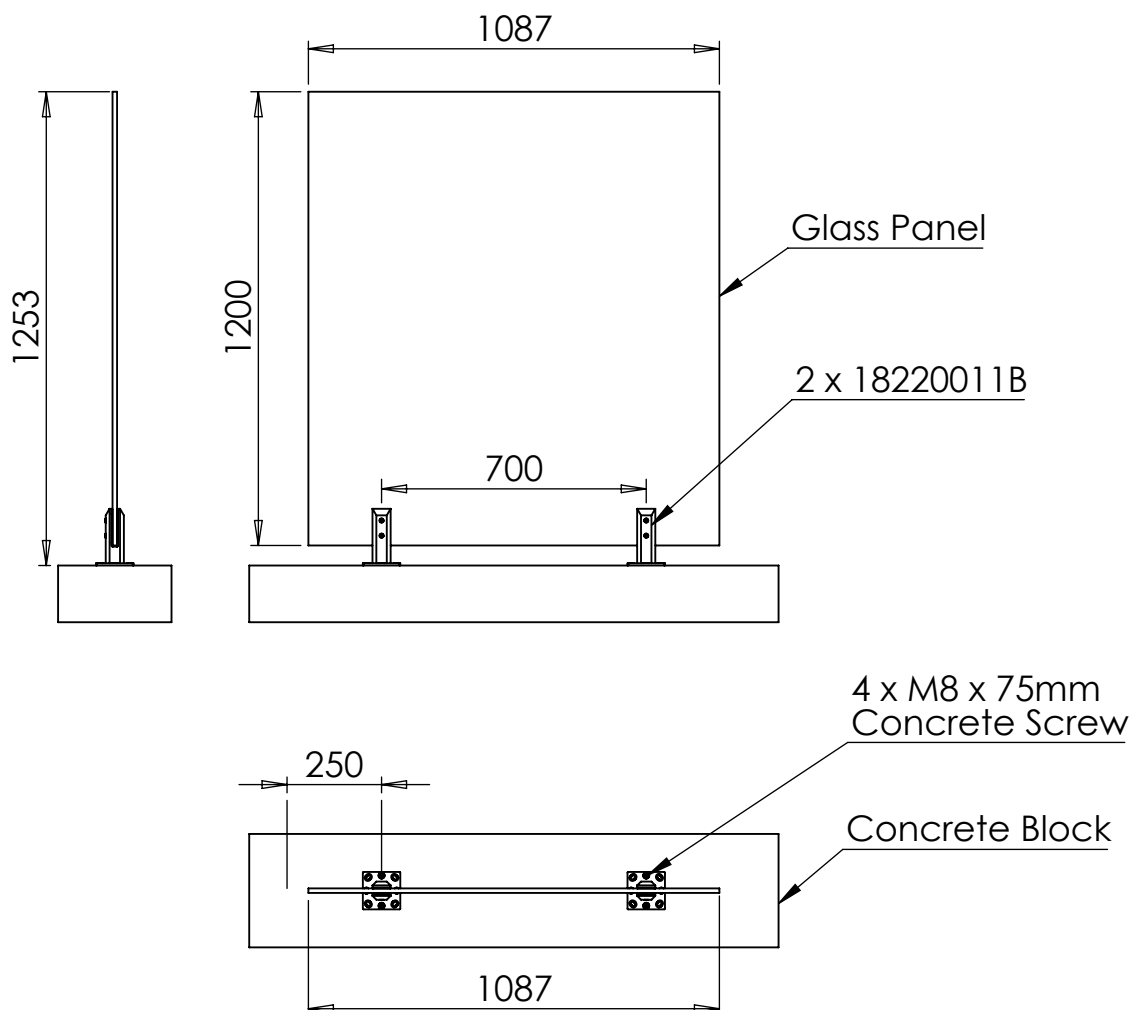
PRO RAILING - DUPLEX BLACK SQUARE SPIGOTS

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN MILLIMETERS



NAME	DATE	REVISION
DRAWN CH	21/04/2021	A
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Load Testing of Pro-Railing Duplex Black Square Spigot System, Which Comprises of Two Spigots With A Range of Glass Panels to BS EN 6180:2011 & UNI 10806:1999

Carry out load testing in accordance with BS 6180:2011 Barriers in and about buildings, and EC1-1991-1-1:2002 UK National Annex to Eurocode 1: Actions on structures – Part 1-1: General actions - Densities, self-weight, imposed loads for buildings.

Carry out load testing in accordance with UNI 10806:1999
Prefabricated Railing Systems - Determination of the mechanical strength under static load.

These tests will allow FH Brundle Duplex Black Square Spigot system to be classified for use in accordance with the Code of Practice included within the standards.

Test In Accordance	Parts Required	Foundation Material	Glass Size & Type	Fixings	Notes
BS EN 6180:2011 UNI 10806:1999	2 x 18220011B	C35 with glass fibres aggregate size 20mm slump 100	1200 x 1087mm 12mm Toughened	M8 x 75mm Concrete Screws	Spigots Spaced at 700mm Centres