

Test Report 8871705.


IMS Nederland B.V.

Introduction.

This report has been prepared by Gary Essam and Chris Rayment and relates to the activity detailed below:

Job/Registration Details	Client Details
Job number: 8871705 Job type: Testing Start Date: 06/02/2018 Test type: Type testing Sample ID: N/A Registration: KM 686207 Scheme: BS 6180:2011 Protocol: PP937 Scheme Mgr: Ian Chamberlain	IMS Nederland B.V. Gildenweg 21 3334 KC Zwijndrecht The Netherlands

The report has been approved for issue by Mark Manito – Team Manager

Approved For Issue	
	Issue Date: 23 February 2018

Objectives.

Type testing of balustrade systems to BS 6180:2011 for product certification

Product Scope.

Various types of balustrade systems

Report Summary.

The samples tested met with the recommended requirements of those clauses to which testing has been performed

Test Requirements.

BS 6180:2011 clauses 6.3.1 and 6.4.1 only

Clauses	Requirements
6.3.1 & 6.4.1	Test and Assessment Please see results in Table A – BS 6180:2011 Report Table starting on Page 4 for testing of the samples as detailed.

Summary of Test Comments.

Zwijndrecht, The Netherlands on 6 and 7 February 2018

Glossary of Terms.

PASS: Complies. Tested by BSI engineers at BSI laboratories.

PASS1: Complies. Witnessed by BSI engineers in manufacturers laboratory.

PASS2: Complies. Tests carried out by third party lab; results accepted by BSI.

PASS*: Report resulted in uncertainty and states that Compliance is more probable than non-compliance.

FAIL: Non compliance – Product does not meet the requirements of this clause.

FAIL*: Report resulted in uncertainty and states that Non-compliance is more probable than compliance.

N/A: Not applicable to design under consideration.

N/T: Not tested due to similarity to previously tested item; reference earlier test report.

Conditions of Issue.

This Test Report is issued subject to the conditions stated in current issue of 'BSI Terms of Service'. The results contained herein apply only to the particular sample(s) tested and to the specific tests carried out, as detailed in this Test Report. The issuing of this Test Report does not indicate any measure of Approval, Certification, Supervision, Control or Surveillance by BSI of any product. No extract, abridgement or abstraction from a Test Report may be published or used to advertise a product without the written consent of BSI, who reserve the absolute right to agree or reject all or any of the details of any items or publicity for which consent may be sought.

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Table A - BS 6180:2011 Report Table

Product Description.

1m nominal lengths of balustrade aluminium extrusion profiles references SB-O 0.5S, SB-O 1S, SB-O 1, SB-O 2, SB-O 3, SB-A 1, SB-A 2 and SB-A 3.

1m x 1.2m nominal sizes of 6.6, 8.8, 10.10 and 12.12 laminated toughened glass and 15mm toughened glass to suit

EXAMINATION AND TEST

CLAUSE

6 DESIGN CRITERIA

6.3 Loading

6.3.1 General

Minimum horizontal imposed loads appropriate to the design of parapets, barriers, balustrades and other elements of structure intended to retain, stop or guide people, should be determined in accordance with Table 2 [of BS 6180:2011], which recommends a uniformly distributed line load for the barrier and a uniformly distributed and point load applied to the infill. These are not additive and should be considered as three separate load cases, all loads being determined according to the type of occupancy which reflects the possible in-service conditions.

Horizontal uniformly distributed line loads should be applied at the design height as presented in Table 1 [of BS 6180:2011] or at the design level 1100mm for barriers higher than the design height.

Uniformly distributed load should be applied at the area below the design height.

Point load should be applied at the most onerous point anywhere on the barrier structure.

6.4 Deflection

6.4.1 Barriers for the protection of people

Barriers for the protection of people should be of adequate strength and stiffness to sustain the applied loads given in Table 2 [of BS 6180:2011]. In addition, a barrier that is structurally safe should not possess sufficient flexibility to alarm building users when subject to normal service conditions. Therefore, for serviceability considerations, the limiting condition for deflection appropriate for a barrier for the protection of people is that the total horizontal displacement of the barrier at any point from its original unloaded position should not exceed the deflection limits determined from the relevant structural design code (where applicable) for the material used, or 25 mm, whichever is the smaller.

EXAMINATION AND TEST (CONTINUED)
CLAUSE
6 DESIGN CRITERIA (CONTINUED)
6.4 Deflection (Continued)
6.4.1 Barriers for the protection of people (Continued)

Where the infill of a barrier is subjected to imposed loads given in Table 2 [of BS 6180:2011], or if appropriate, other calculated design loads, the displacement of any point of the barrier should not exceed $L/65$ or 25 mm, whichever is the smaller where L is the given in **8.3**, **8.4** or defined in **8.5** [of BS 6180:2011]. A suitable fracture load, factored by a minimum partial safety factor of 4.0 (as recommended in BS 4592-0) should be obtained from the material manufacturer when considering glass barrier design.

Table 2 Minimum horizontal imposed loads for parapets, barriers and balustrades

Type of occupancy for part of the building or structure	Examples of specific use	Horizontal uniformly distributed line load (kN/m)	Uniformly distributed load applied to the infill (kN/m ²)	A point load applied to part of the infill (kN)
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	0.5	0.25
	(ii) Other residential, i.e. houses of multiple occupancy and balconies, including Juliette balconies and edges of roofs in single family dwellings	0.74	1.0	0.5
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	0.5	0.25
	(v) Areas not susceptible to overcrowding in office and institutional buildings, also industrial and storage buildings except as given above	0.74	1.0	0.5

Table 2 Minimum horizontal imposed loads for parapets, barriers and balustrades (Continued)

Type of occupancy for part of the building or structure	Examples of specific use	Horizontal uniformly distributed line load (kN/m)	Uniformly distributed load applied to the infill (kN/m ²)	A point load applied to part of the infill (kN)
Areas where people might congregate	(vi) Areas having fixed seating within 530 mm of the barrier, balustrade or parapet	1.5	1.5	1.5
Areas with tables or fixed seatings	(vii) Restaurants and bars	1.5	1.5	1.5
Areas without obstacles for moving people and not susceptible to overcrowding	(viii) Stairs, landings, corridors, ramps 0.74	0.74	1.0	0.5
	(ix) External balconies including Juliette balconies and edges of roofs. Footways and pavements within building curtilage adjacent to basement/sunken areas	0.74	1.0	0.5
Areas susceptible to overcrowding	(x) Footways or pavements less than 3 m wide adjacent to sunken areas	1.5	1.5	1.5
	(xi) Theatres, cinemas, discotheques, bars, auditoria, shopping malls, assembly areas, studio. Footways or pavements greater than 3 m wide adjacent to sunken areas.	3.0	1.5	1.5
	(xii) Grandstands and stadia ^{A)}	-	-	-
Retail areas	(xiii) All retail areas including public areas of banks/building societies or betting shops	1.5	1.5	1.5
Vehicular	(xiv) Pedestrian areas in car parks, including stairs, landings, ramps, edges or internal floors, footways, edges of roofs	1.5	1.5	1.5
	(xv) Horizontal loads imposed by vehicles ^{B)}	-	-	-

A) See requirements of the appropriate certifying authority

B) See Annex A of BS 6180:2011

EXAMINATION AND TEST (CONTINUED)

TEST METHODS

A single section of each type of balustrade extrusion profile was bolted to a nominal 3.0m x 2.0m x 0.5m concrete block in accordance with the manufacturer's instructions. Samples of suitable thicknesses of glass were then inserted and fixed, again, in accordance with the manufacturer's instructions

Horizontal uniformly distributed line loads

A 1000mm x 100mm x 75mm wooden bar was clamped to one side of the barrier glass at a height of 1100mm from the top of the concrete block which represented floor level. The horizontal uniformly distributed line loads were applied at two points to the wooden bar at approximately 300mm from each end by webbing straps which were attached to a calibrated digital balance and then to a manual cable winch. The loads were increased to the calculated equivalent force to give the appropriate line load and held for 5 minutes. The deflections at a height of 1100mm from the top of the concrete block were then measured using a calibrated digital indicator on the opposite side of the barrier glass from the loading.



Typical arrangements for application of horizontal uniformly distributed line loading assembly

Uniformly distributed load applied to the infill

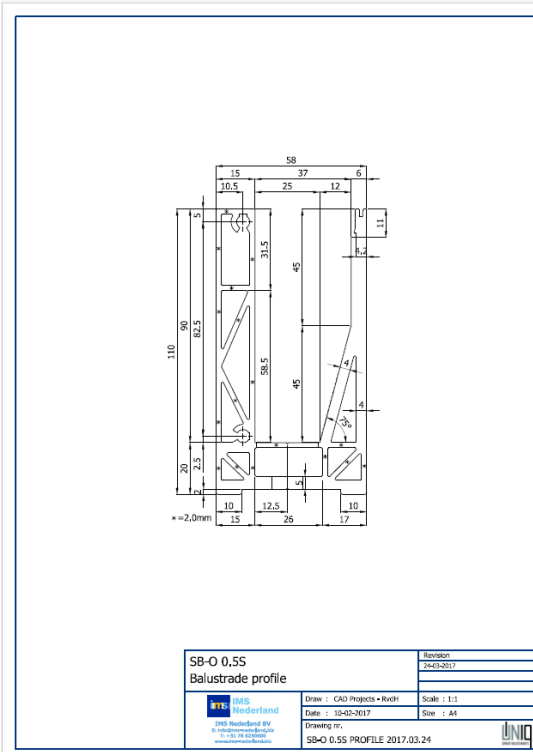
The uniformly distributed loading was not applicable to the types of balustrade systems tested.

Point load applied to part of the infill

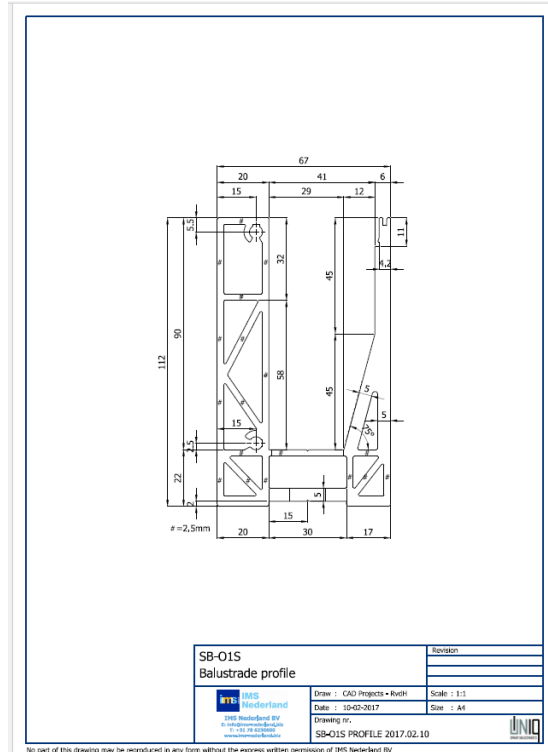
The point loading was not applicable to the types of balustrade systems tested.

EXAMINATION AND TEST (CONTINUED)

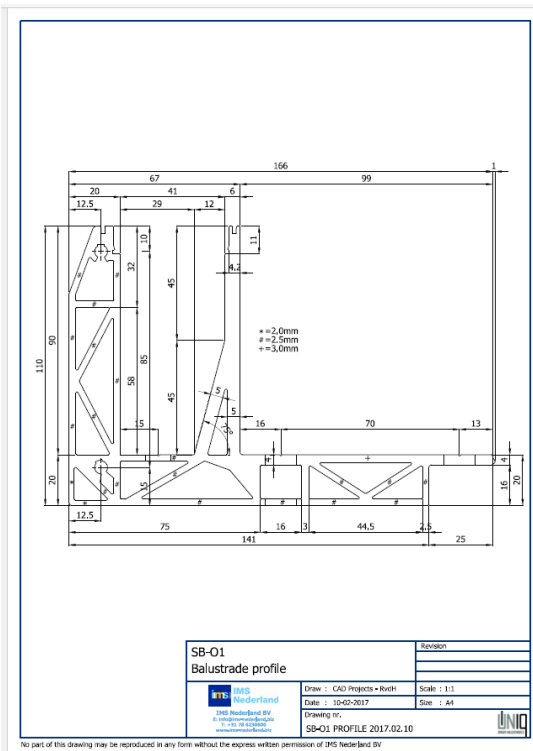
TEST METHODS (Continued)



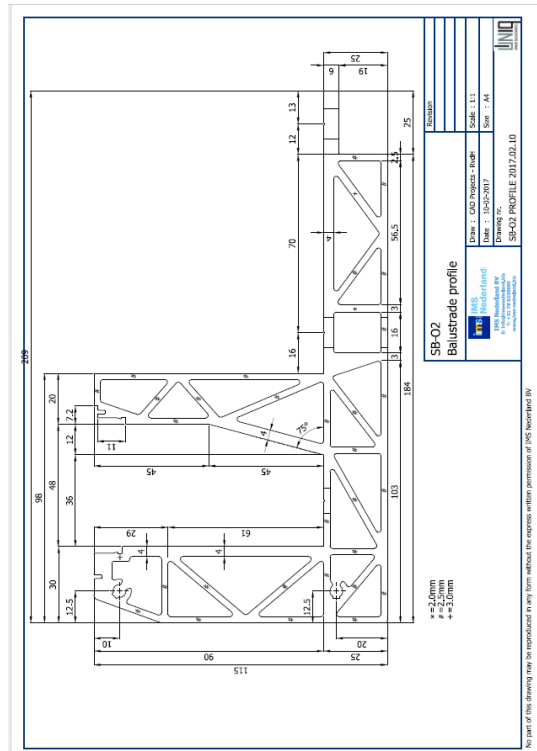
SB-O 0.5S balustrade extrusion profile



SB-O 1S balustrade extrusion profile



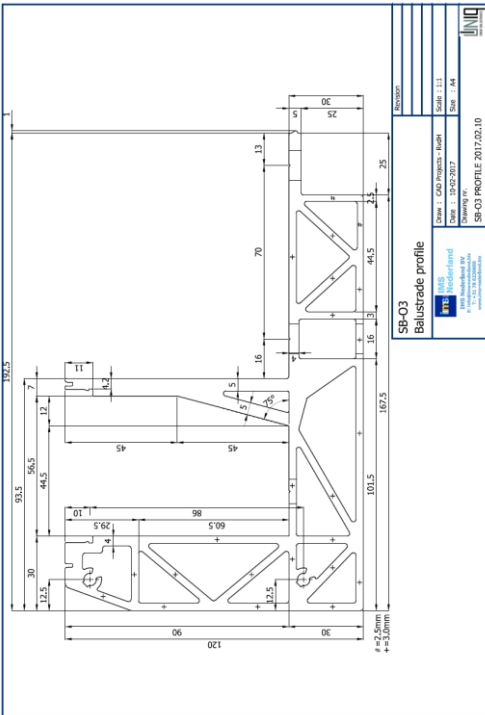
SB-O 1 balustrade extrusion profile



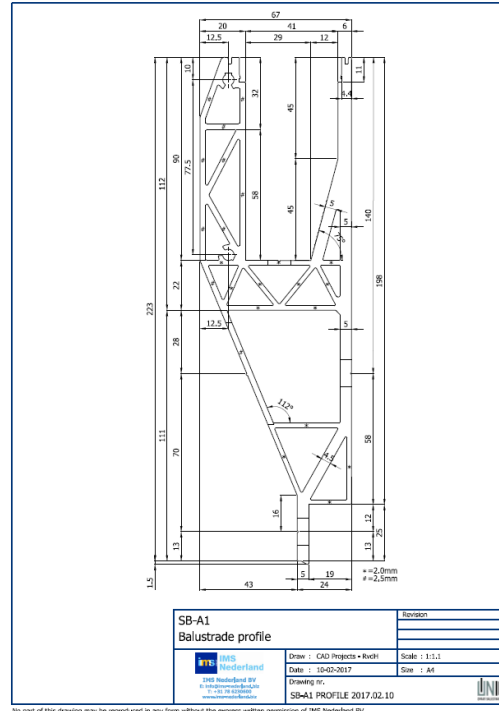
SB-O 2 balustrade extrusion profile

EXAMINATION AND TEST (CONTINUED)

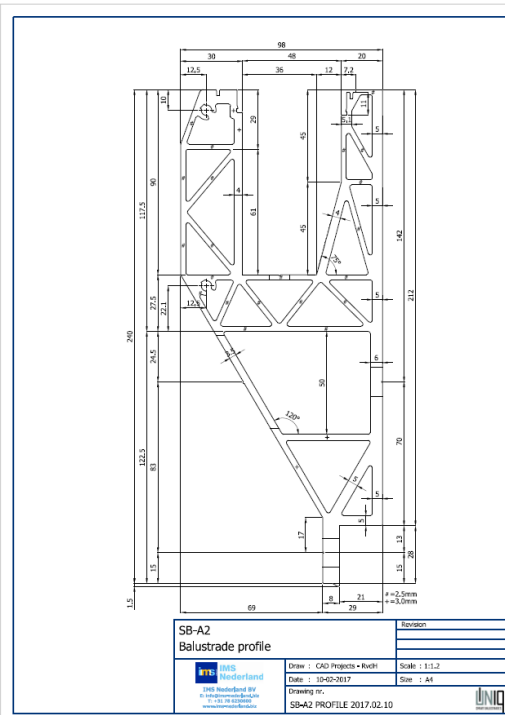
TEST METHODS (Continued)



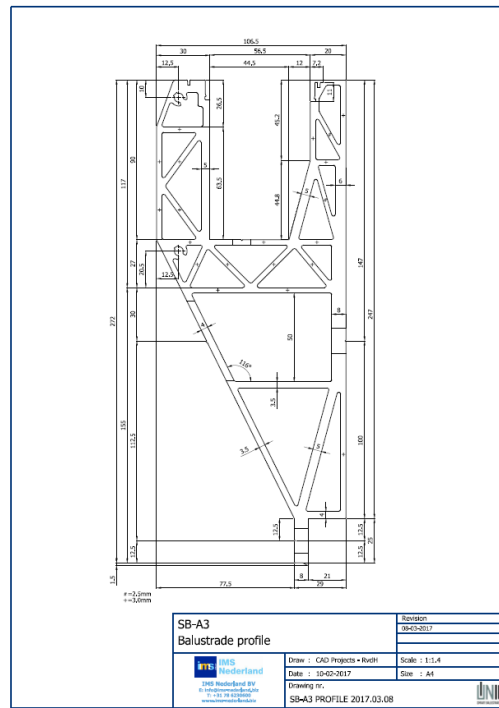
SB-O 3 balustrade extrusion profile



SB-A 1 balustrade extrusion profile



SB-A 2 balustrade extrusion profile



SB-A 3 balustrade extrusion profile

SUMMARY OF TESTING
Horizontal uniformly distributed line loads

System reference	Mount	Glass size (W x H) (mm x mm)	Glass thickness (mm)	Glass type	Line load (kN/m)	Theoretical deflection (mm)	Actual deflection (mm)
A	SB-O 0.5S	1000 x 1180	6.6	Laminated	0.36	20.2	18.4
B	SB-O 1.0S	1000 x 1290	8.8	Laminated	0.74	20.7	21.9
C	SB-O 1.0S	1000 x 1230	15	Monolithic	0.74	20.1	21.3 ¹⁾
D	SB-O 1	1000 x 1290	8.8	Laminated	0.74	20.7	22.3
E	SB-O 2	1000 x 1180	12.12	Laminated	1.5	17.4	20.0
F	SB-O 3	1175 x 1325	15.15	Laminated	3.0	21.3	25.0 ²⁾
G	SB-A 1	1000 x 1290	8.8	Laminated	0.74	22.6	24.6
H	SB-A 2	1000 x 1180	12.12	Laminated	1.5	17.9	20.3
I	SB-A 3	1175 x 1325	15.15	Laminated	3.0	21.8	23.8

Notes:

- 1) No further testing of monolithic glass was performed as it showed less deflection than the laminated equivalent
- 2) Marginal result

**EXAMINATION AND TEST (CONTINUED)
SUMMARY OF SUITABILITY OF BARRIER SYSTEMS**

Type of occupancy for part of the building or structure	Examples of specific use	Horizontal uniformly distributed line load (kN/m)	System								
			A	B	C	D	E	F	G	H	I
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	✓	✓	✓	✓	✓	✓	✓	✓	✓
	(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	✓	✓	✓	✓	✓	✓	✓	✓
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	✓	✓	✓	✓	✓	✓	✓	✓	✓
	(v) Areas not susceptible to overcrowding in office and institutional buildings, also industrial and storage buildings except as given above	0.74	X	✓	✓	✓	✓	✓	✓	✓	✓
Areas where people might congregate	(vi) Areas having fixed seating within 530 mm of the barrier, balustrade or parapet	1.5	X	X	X	X	✓	✓	X	✓	✓
Areas with tables or fixed seatings	(vii) Restaurants and bars	1.5	X	X	X	X	✓	✓	X	✓	✓
Areas without obstacles for moving people and not susceptible to overcrowding	(viii) Stairs, landings, corridors, ramps	0.74	X	✓	✓	✓	✓	✓	✓	✓	✓
	(ix) External balconies including Juliette balconies and edges of roofs. Footways and pavements within building curtilage adjacent to basement/sunken areas	0.74	X	✓	✓	✓	✓	✓	✓	✓	✓

EXAMINATION AND TEST (CONTINUED)
SUMMARY OF SUITABILITY OF BARRIER SYSTEMS (Continued)

Type of occupancy for part of the building or structure	Examples of specific use	Horizontal uniformly distributed line load (kN/m)	System								
			A	B	C	D	E	F	G	H	I
Areas susceptible to overcrowding	(x) Footways or pavements less than 3 m wide adjacent to sunken areas	1.5	X	X	X	X	✓	✓	X	✓	✓
	(xi) Theatres, cinemas, discotheques, bars, auditoria, shopping malls, assembly areas, studio. Footways or pavements greater than 3 m wide adjacent to sunken areas.	3.0	X	X	X	X	X	✓	X	X	✓
	(xii) Grandstands and stadia ^{A)}	-	-	-	-	-	-	-	-	-	-
Retail areas	(xiii) All retail areas including public areas of banks/building societies or betting shops	1.5	X	X	X	X	✓	✓	X	✓	✓
Vehicular	(xiv) Pedestrian areas in car parks, including stairs, landings, ramps, edges or internal floors, footways, edges of roofs	1.5	X	X	X	X	✓	✓	X	✓	✓
	(xv) Horizontal loads imposed by vehicles ^{B)}	-	-	-	-	-	-	-	-	-	-

*** End of Report ***