

# ALUMINCO S.A.

## TEST REPORT

**SCOPE OF WORK**

STRUCTURAL PERFORMANCE TESTING ON THE 51 IN. BY 40 IN. *OPEN AIR* ALUMINUM AND GLASS GUARDRAIL SYSTEM WITH AN OPERABLE PANEL

**REPORT NUMBER**

H6052.01-119-19-R0

**TEST DATE(S)**

12/14/17

**ISSUE DATE**

03/19/18

**RECORD RETENTION END DATE**

12/14/21

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**DOCUMENT CONTROL NUMBER**

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## TEST REPORT FOR ALUMINCO S.A.

Report No.: H6052.01-119-19-R0

Date: 03/19/18

### REPORT ISSUED TO

#### ALUMINCO S.A. ENGINEERING DIVISION

Inofita

Viotia, 32011

Greece

### SECTION 1

#### SCOPE

Intertek Building & Construction (B&C) was contracted by Aluminco S.A., Greece to perform structural performance testing in accordance with the 2015 IBC on their *Open Air* aluminum and glass guardrail system with an operable panel attached to aluminum structural post mounts. The system was evaluated for the design load requirements noted within Section 1607.8.1 and the safety factor requirements noted within Section 2407.1.1 of the 2015 International Building Code®, International Code Council.

Testing was conducted at the Intertek B&C test facility in York, PA. Intertek B&C has demonstrated compliance with ISO/IEC International Standard 17025 and is consequently accredited as a Testing Laboratory (TL-144) by International Accreditation Service, Inc. (IAS). This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

For INTERTEK B&C:

<b>COMPLETED BY:</b>	Emily C. Riley	<b>REVIEWED BY:</b>	V. Thomas Mickley, Jr., P.E.
<b>TITLE:</b>	Project Manager	<b>TITLE:</b>	Senior Staff Engineer
<b>SIGNATURE:</b>		<b>SIGNATURE:</b>	
<b>DATE:</b>	03/19/18	<b>DATE:</b>	03/19/18

ARB:ecr/vtm/aaa

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### SECTION 2

#### TEST METHOD(S)

The specimen was evaluated in accordance with the following:

**2015**, *International Building Code*<sup>®</sup>, International Code Council

**2015**, *International Residential Code*<sup>®</sup>, International Code Council

Structural tests were performed according to Chapter 17 (Structural Tests and Special Inspections) of IBC 2015.

#### Limitations

All tests performed were to evaluate structural performance of the guardrail assembly to carry and transfer imposed loads to the supporting structure. The specimen(s) were evaluated in accordance with the 2015 IBC performance requirements. The test specimens evaluated included the rails and their connection to the support posts, the glass panels and the support posts. Anchorage of the mounting shoes to the supporting structure is not included in the scope of this testing and would need to be evaluated separately. Additional testing would be required to substantiate compliance with the referenced building codes because the system was not fully evaluated with the operable panel in the raised position.

### SECTION 3

#### MATERIAL SOURCE/INSTALLATION

All materials utilized for testing reported herein were provided to Intertek B&C by Aluminco, S.A. and were not sampled or selected by an independent inspection agency.

Test samples were provided by the client. Representative samples of the test specimen(s) will be retained by Intertek B&C for a minimum of four years from the test completion date.

Test specimens were inspected prior to testing to verify the condition of the materials was suitable for testing. No potentially compromising defects were observed.

### SECTION 4

#### EQUIPMENT

The railing system was tested in a self-contained structural frame designed to accommodate anchorage of the guardrail assembly and application of the required test loads. The specimens were loaded using a hydraulic actuator attached to a forklift. Applied load was measured using an electronic load cell located in-line with the loading system. Electronic linear motion transducers were used to measure deflections.

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### SECTION 5

#### LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Christos Palaiologos	Aluminco S.A.
Adam Schrum	Intertek B&C
Alva R. Baker	Intertek B&C

### SECTION 6

#### TEST PROCEDURE

Each test specimen was inspected prior to testing to verify size and general condition of the materials, assembly, and installation. No potentially compromising defects were observed prior to testing.

The railing assembly was installed and tested as a single panel section by directly securing (surface-mounting) the support posts to a rigid steel channel (simulated concrete installation). The railing was assembled by representatives of Aluminco, S.A. Transducers mounted to an independent reference frame were located to record movement of reference points on the guardrail system components at the point of load application. See photographs in Section 10 for test setups.

An initial load, not exceeding 50% of design load, was applied and transducers were zeroed. Load was then applied at a steady uniform rate until reaching 2.0 times design load. After reaching 2.0 times design load, the load was released. After allowing a minimum period of one minute for stabilization, load was reapplied to the initial load level used at the start of the loading procedure, and deflections were recorded and used to analyze recovery. Load was then increased at a steady uniform rate until reaching 4.0 times design load or until failure occurred. The testing time was continually recorded from the application of initial test load until the ultimate test load was reached.

Deflection and permanent set were component deflections relative to their end-points; they were not overall system displacements. All loads and displacement measurements were horizontal, unless noted otherwise.

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### SECTION 7

#### TEST SPECIMEN DESCRIPTION

The *Open Air* guardrail system consisted of extruded aluminum support posts and extruded aluminum rails with glass panels. The assembly measured 47-5/8 in long (clear space between support posts) with an overall rail height (deck surface to top of top rail) of 39-1/2 in. Drawings are included in Section 11 to verify the overall dimensions and other pertinent information of the tested product, its components, and any constructed assemblies. Photographs are provided in Section 10.

<b>FIXED PANEL TOP RAIL (CAP)</b>	
<b>OPERABLE PANEL TOP RAIL (CAP)</b>	Extruded aluminum profile
<b>RAIL HEIGHT</b>	39-1/2 in (deck surface to top of top rail)
<b>BOTTOM RAIL</b>	3-1/2 in wide by 2 in high by 0.080 in thick extruded aluminum tube
<b>FIXED GLASS PANEL INFILL</b>	3/8 in thick laminated glass constructed from two sheets of 5/32 in tempered glass and an 0.080 in thick PVB interlayer
<b>OPERABLE GLASS PANEL INFILL</b>	1/4 in thick laminated glass constructed from two sheets of 1/8 in thick annealed glass and an 0.060 in thick PVB interlayer
<b>BOTTOM RAIL ATTACHMENT TO FIXED PANEL SUPPORT POST</b>	3-1/4 in wide by 1-3/4 in high by 1-1/2 in deep by 0.100 in thick extruded aluminum shear block
<b>TOP RAIL (CAP) ATTACHMENT</b>	Top rail caps were secured to the operable and fixed panels using a bead of silicone
<b>OPERABLE PANEL SUPPORT POST</b>	1-3/4 in by 1-5/16 in by 0.080 in thick extruded aluminum tube, nested in fixed panel support post
<b>FIXED PANEL SUPPORT POST</b>	3-1/2 in by 2 in by 0.125 in wall extruded aluminum tube
<b>BASE PLATE</b>	3-3/16 in wide by 7-7/8 in long by 3/8 in thick aluminum plate with two 7/16 in diameter holes and four 1/4 in diameter holes

<b>HARDWARE</b>	<b>DESCRIPTION</b>
<b>COMPRESSION SPRING</b>	Secured to each operable panel support post at the bottom end using four #8-18 x 2 in long (0.118 in minor diameter) Phillips drive, pan head screws. Retained at the top end of the operable panel support post using an extruded aluminum cap secured to the post using two #12-24 x 3/8 in long Allen drive, flat head screws

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**Fastening Schedule**

CONNECTION	FASTENER
GLASS PANEL INFILL TO POSTS	The glass panels were set onto the posts using a double sided adhesive glazing tape and a bead of silicone
SHEAR BLOCK TO POST	Two 1/4-14 x 2 in long (0.180 in minor diameter) Phillips drive, flat head screws
SHEAR BLOCK TO RAIL	One #8-18 x 3/4 in long (0.116 in minor diameter) square drive, pan head screw
BASE PLATE TO POST	Four 1/4-14 x 2 in long (0.180 in minor diameter) Phillips drive, flat head screws
POST MOUNT TO SUBSTRUCTURE	Two 3/8 in Grade 5 hex-head bolts with washer and nut

**SECTION 8**

**TEST RESULTS**

**Key to Test Results Tables:**

Load Level: Target test load

Test Load: Actual applied load at the designated load level (target).

Elapsed Time (E.T.): The amount of time into the test with zero established at the beginning of the loading procedure.

**TEST NO. 1 - 12/14/17**

**DESIGN LOAD: 50 lb / 1 Square ft at Center of In-fill (Adjacent to Post)**

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	MAX DISPLACEMENT (in)
Initial Load	18	00:00	0.00
2.0x Design Load	101	00:24	0.05
Initial Load	12	01:30	0.00
100% Recovery from 2.0 x Design Load			
4.0x Design Load	201	01:53	Achieved Load without Failure

**TEST NO. 2 - 12/14/17**

**DESIGN LOAD: 50 lb / 1 Square ft at Center of In-fill (Midspan)**

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	MAX DISPLACEMENT (in)
Initial Load	14	00:00	0.00
2.0x Design Load	101	00:30	0.03
Initial Load	14	01:52	0.00
100% Recovery from 2.0 x Design Load			
4.0x Design Load	202	02:14	Achieved Load without Failure

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**TEST NO. 3 - 12/14/17**

**DESIGN LOAD: 200 lb Concentrated Load at Midspan Top Rail**

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	DISPLACEMENT (in)			
			END	MID	END	NET <sup>1</sup>
Initial Load	50	00:00	0.00	0.00	0.00	0.00
2.0x Design Load	403	00:34	0.56	1.06	0.45	0.56
Initial Load	50	02:30	0.04	0.06	0.03	0.03
95% Recovery from 2.0 x Design Load						
4.0x Design Load	803	03:28	Achieved Load without Failure			

<sup>1</sup> Net displacement was the top rail displacement relative to its ends.

**Test No. 4 - 12/14/17**

**DESIGN LOAD: 200 lb Concentrated Load at Midspan of Top Rail (Vertical)**

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	MAX DISPLACEMENT (in)
Initial Load	53	00:00	0.00
2.0x Design Load	404	00:30	0.03
Initial Load	50	01:44	0.00
100% Recovery from 2.0 x Design Load			
2.5x Design Load	806	02:17	Achieved Load without Failure

**Test No. 5 - 12/14/17**

**DESIGN LOAD: 200 lb Concentrated Load at Top of Post**

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	POST DISPLACEMENT (in)
Initial Load	50	00:00	0.00
2.0x Design Load	400	00:31	0.88
Initial Load	50	02:24	0.01
99% Recovery from 2.0 x Design Load			
2.5x Design Load	500	03:00	Achieved Load without Failure

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### SECTION 9

#### CONCLUSION

Anchorage of the support post to the supporting structure is not included in the scope of this testing and would need to be evaluated separately. All tests were completed with the operable panel in the seated position. Withstanding an ultimate load of 4.0 times design load, the tests reported herein for the 47-5/8 in wide by 40 in high railing assembly (*Open Air*) meet the requirements of the 2015, *International Residential Code*, limited to use in One- and Two-Family Dwellings. Additional testing would be required to substantiate compliance with the referenced building codes because the system was not fully evaluated with the operable panel in the raised position.

### SECTION 10

#### PHOTOGRAPHS



Photo No. 1

Infill Load Test at Center of Infill (Adjacent to Post)



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**Photo No. 2**  
**In-Fill Load Test at Center of Infill (Midspan)**



**Photo No. 3**  
**Concentrated Load at Top Rail Midspan**

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**Photo No. 4**  
**Concentrated Load at Midspan of Top Rail (Vertical)**



**Photo No. 5**  
**Concentrated Load Test at Top of Post**



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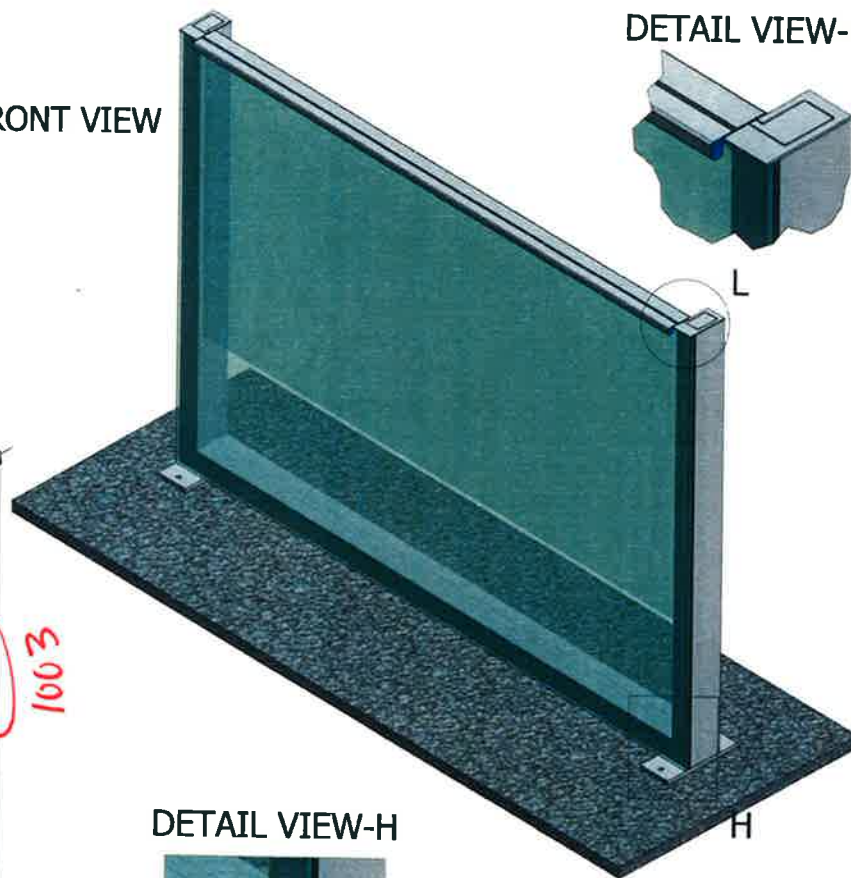
### SECTION 11 DRAWINGS

The drawings of the *Open Air* aluminum and glass guardrail system which follow have been reviewed by Intertek B&C and are representative of the project reported herein. Project construction was verified by Intertek B&C per the drawings included in this report. Any deviations are documented herein or on the drawings.

DETAIL VIEW-K



OPEN AIR RAIL FRONT VIEW



DETAIL VIEW-L



K

RAIL TOP - TYPE U

1500  
1302

1100  
1003

L

H

2200-102  
2200-903  
2200-904

1400  
1210

OPEN AIR RAIL REAR VIEW

DETAIL VIEW-H



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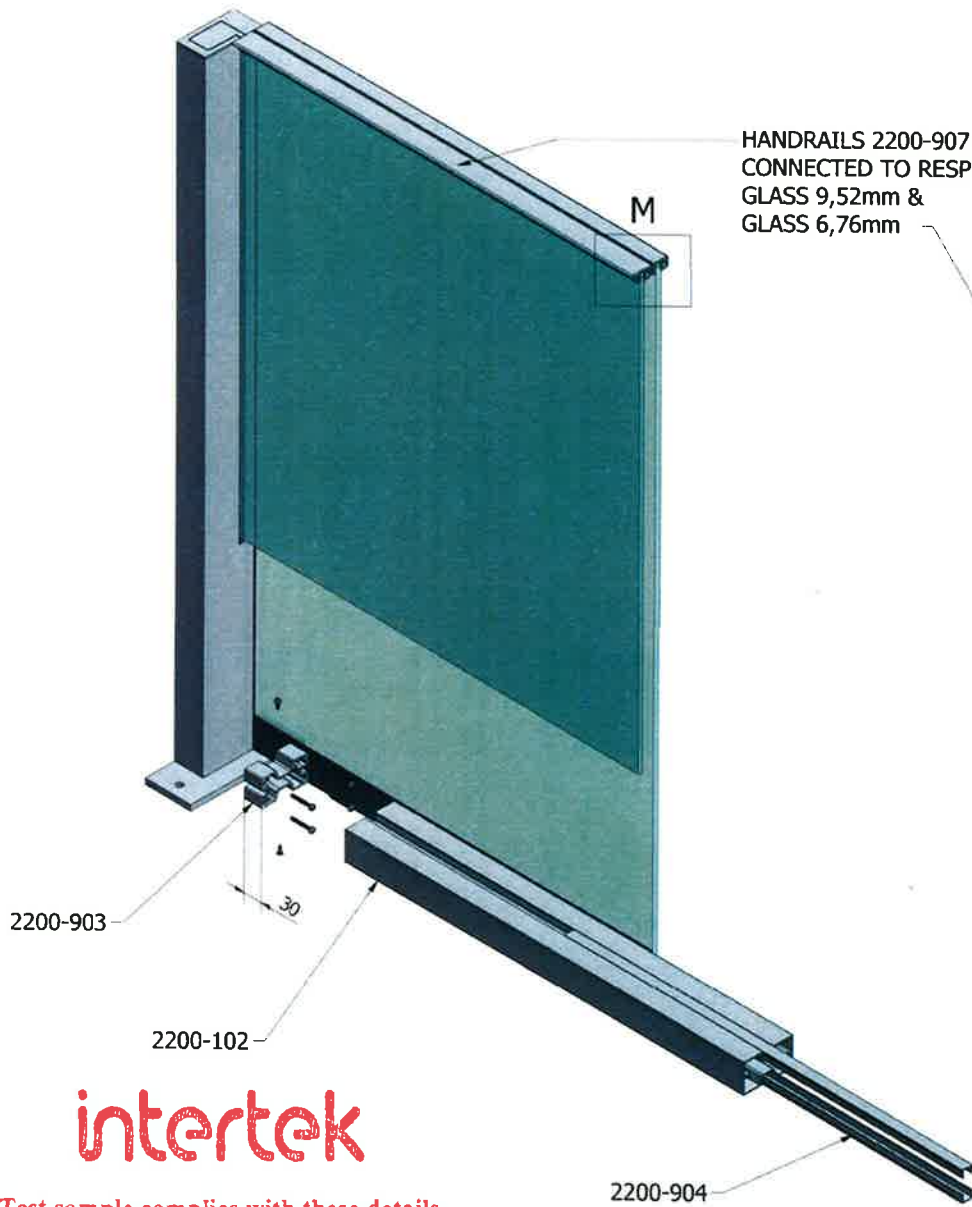
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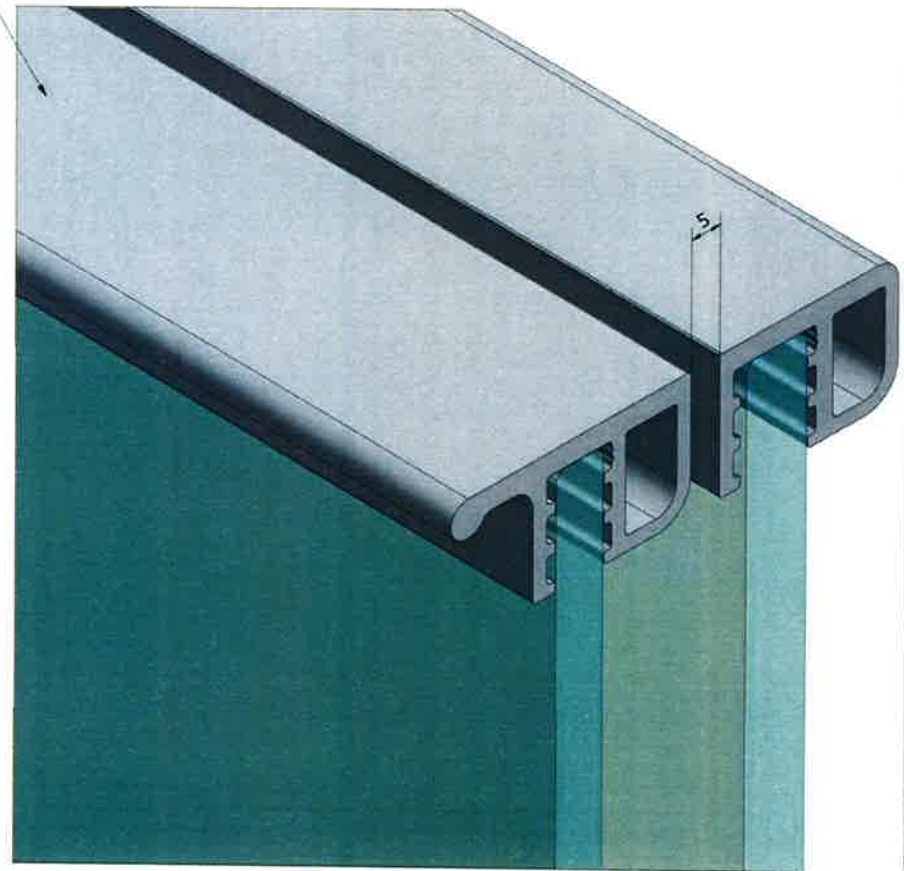
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				27/11/2017
<b>ALUMINCO</b> ALUMINIUM BUILDING SYSTEMS			Open Air-Altered Solution	Edition Sheet 2 / 11





HANDRAILS 2200-907 / 2200-908  
 CONNECTED TO RESPECTIVE:  
 GLASS 9,52mm &  
 GLASS 6,76mm

DETAIL VIEW-M



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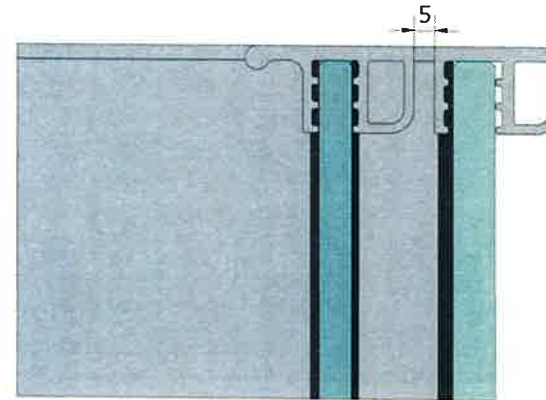


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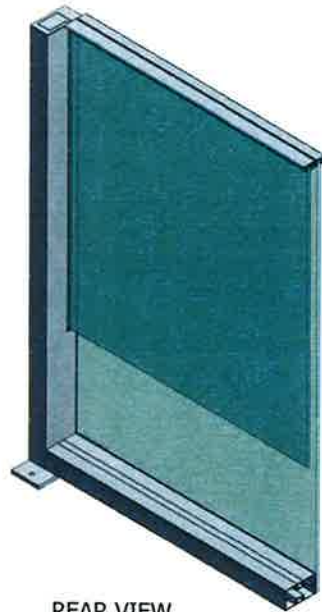
OPEN AIR RAIL  
SIDE SECTION VIEW  
- CLOSED POSITION -



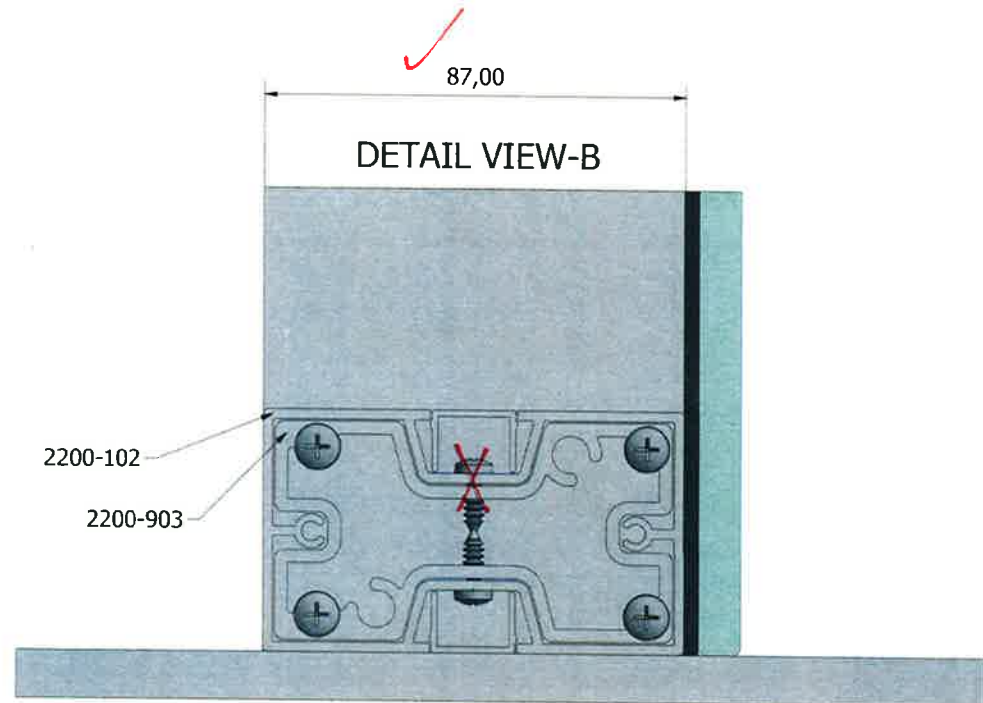
DETAIL VIEW-C



FRONT VIEW



REAR VIEW



DETAIL VIEW-B

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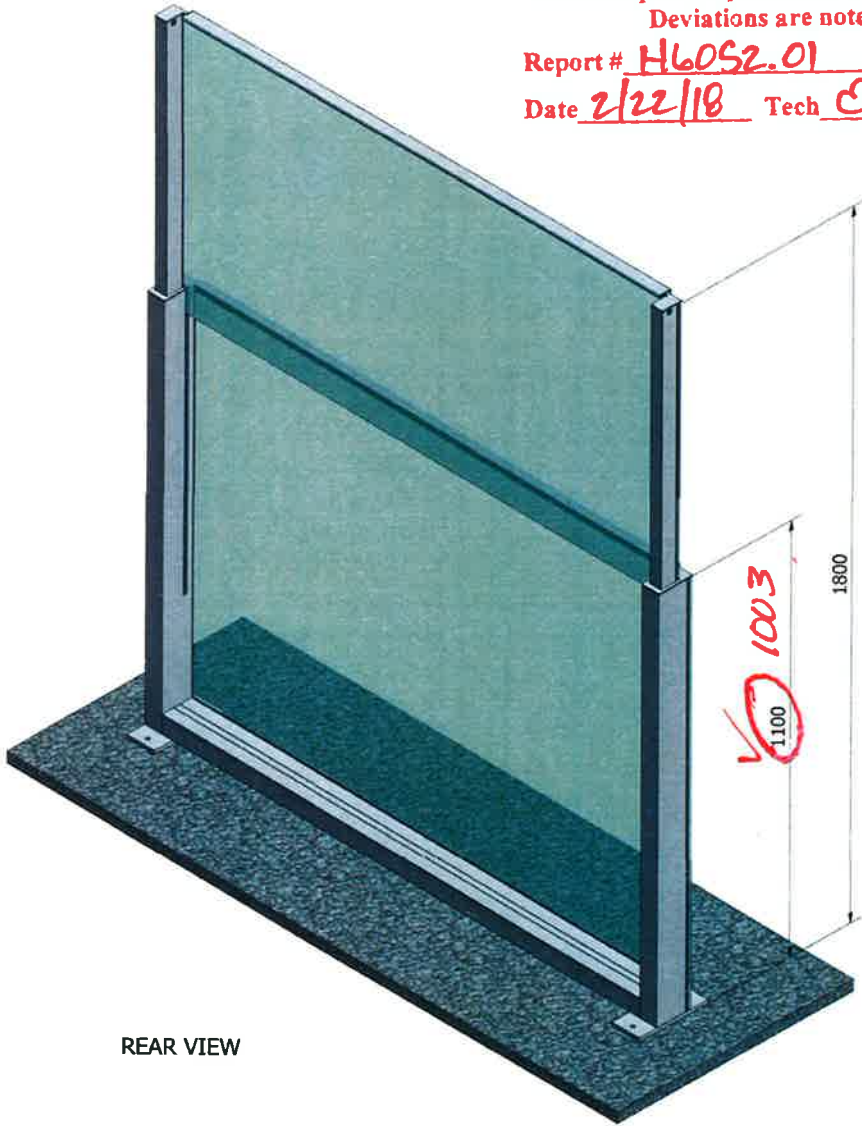
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Edition  
Sheet  
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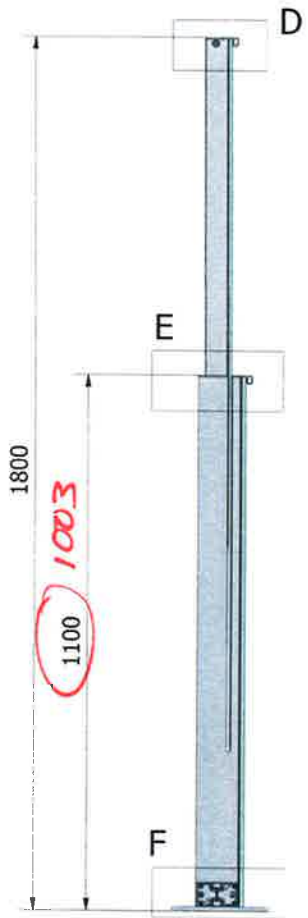
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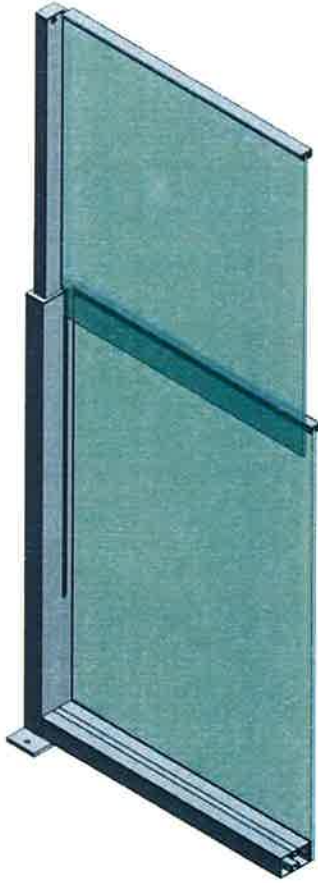


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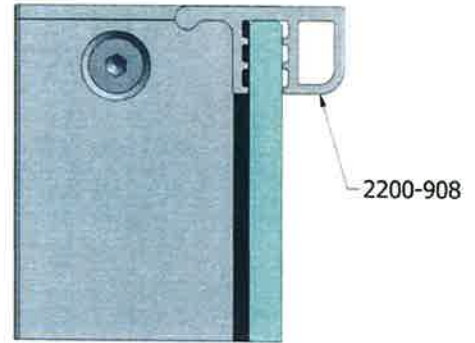




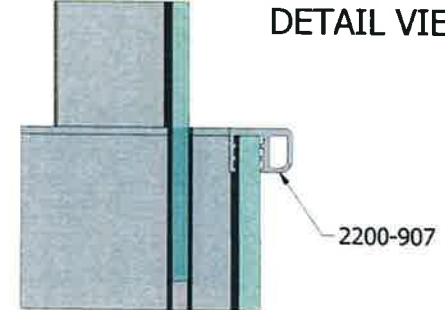
OPEN AIR RAIL  
SIDE SECTION VIEW  
- OPEN POSITION -



DETAIL VIEW-D



DETAIL VIEW-E

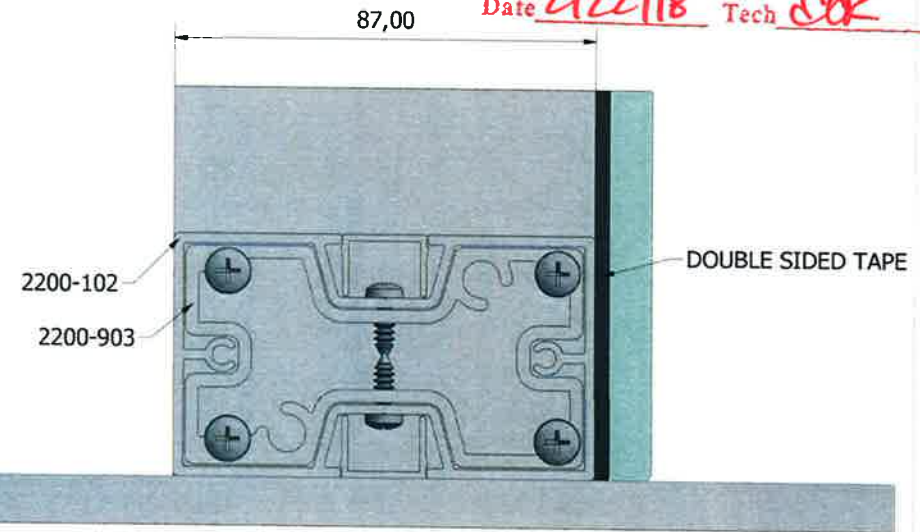


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DETAIL VIEW-F

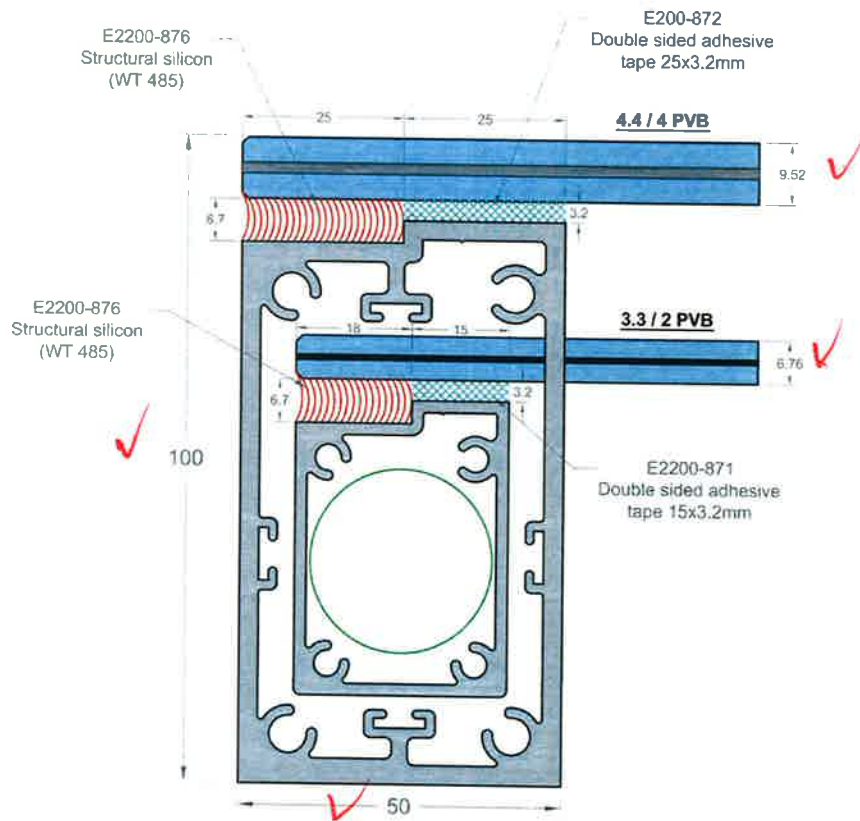


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Open Air-Altered Solution Edition Sheet  
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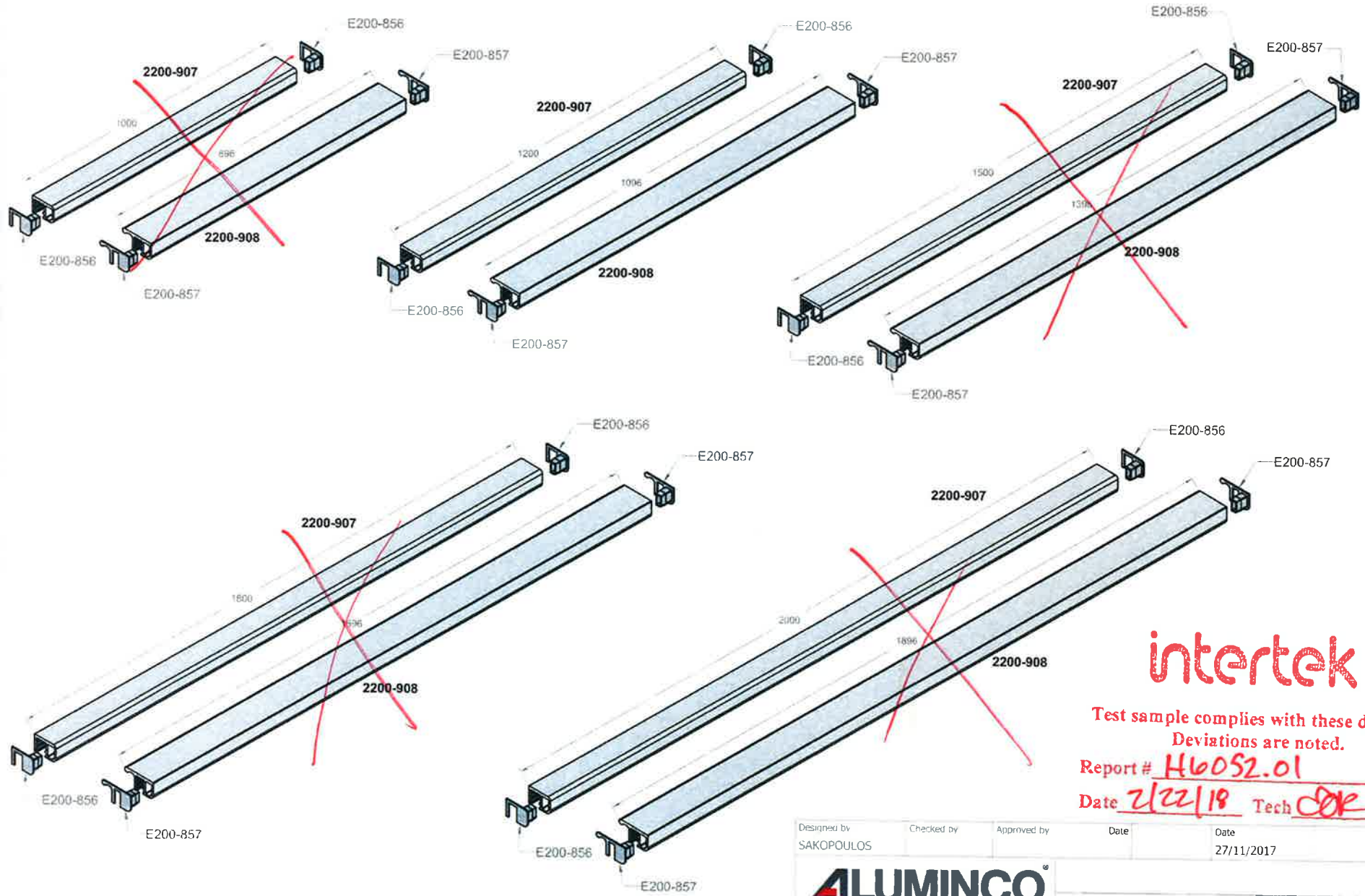
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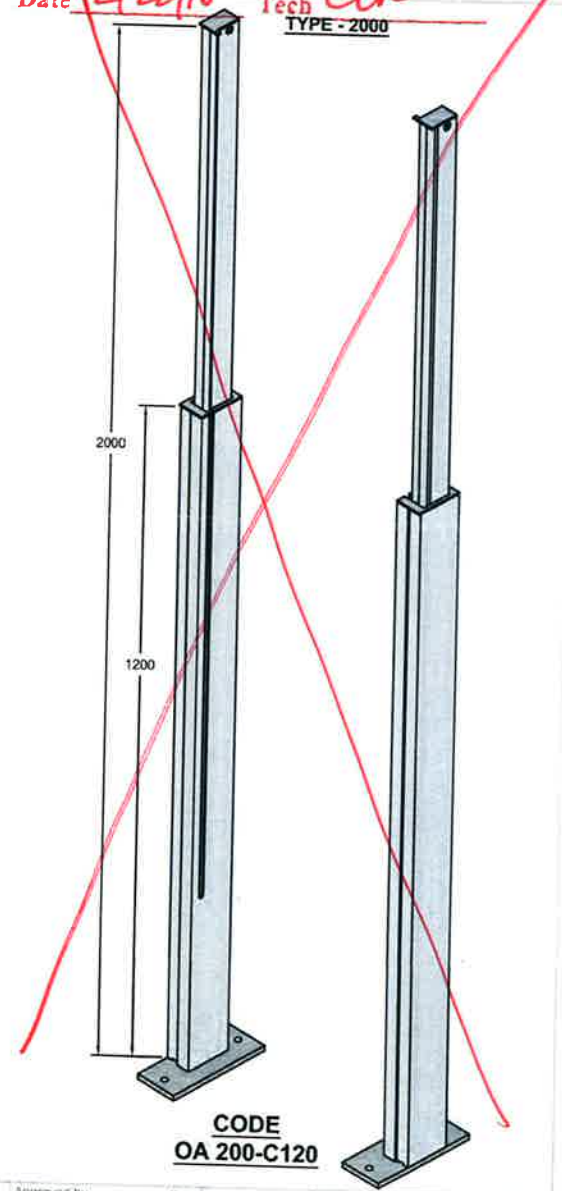
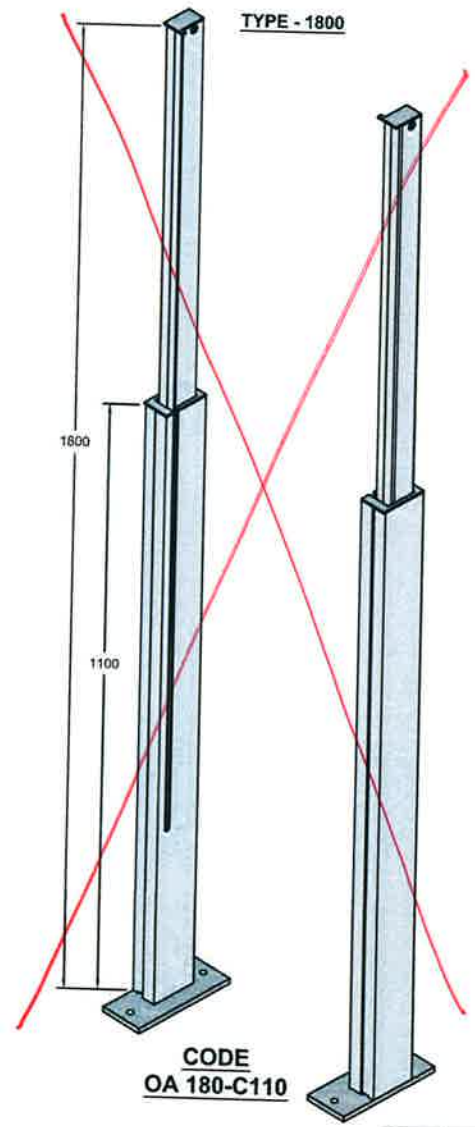
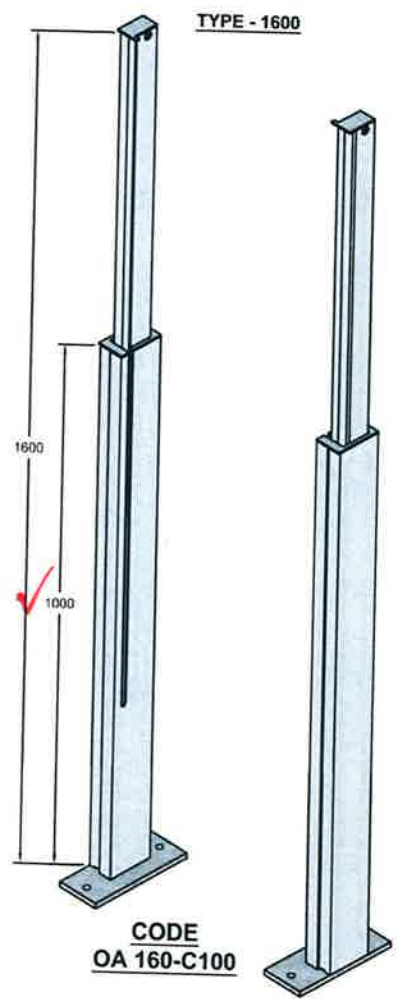
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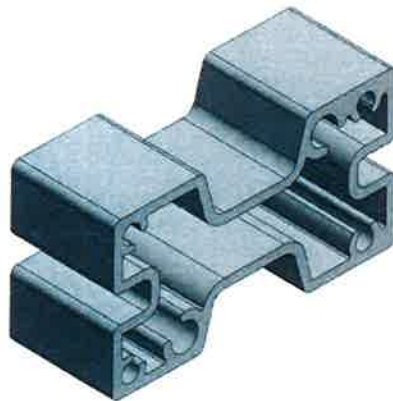
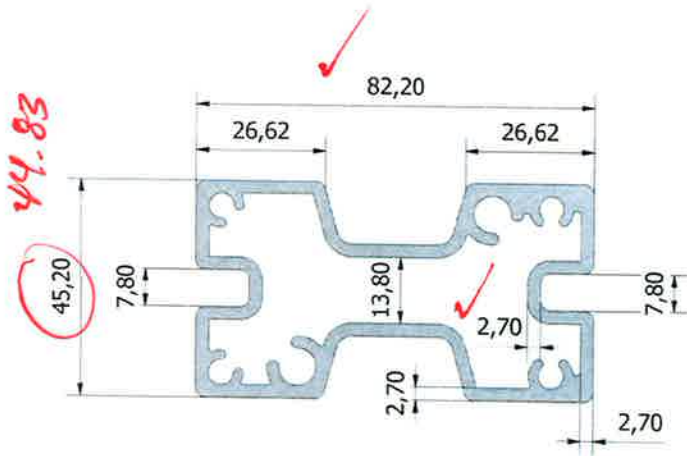
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Material: AL 6060-T6  
Weight: 2754 gr/m

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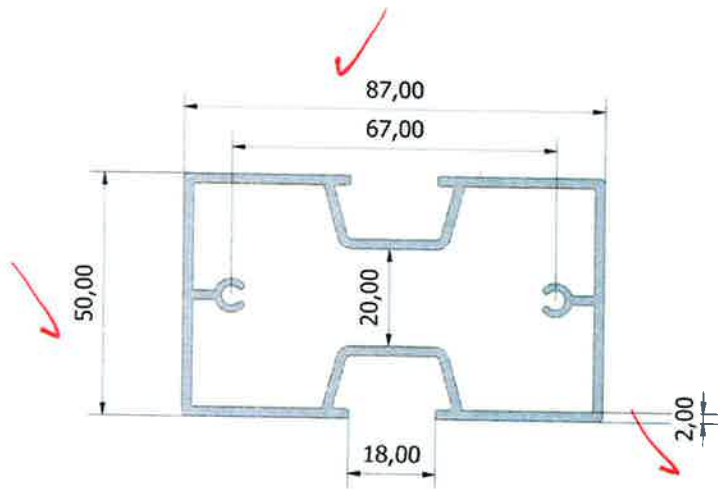
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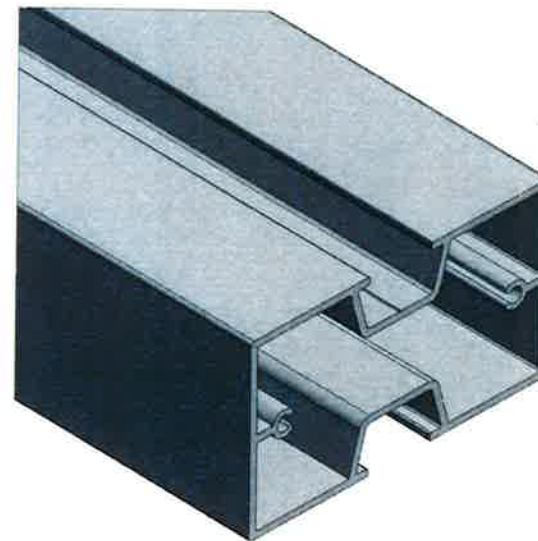
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			Open Air-Altered Solution	Edtion 9 / 11





DETAIL VIEW



Material: AL 6060-T6  
Weight: 1885 gr/m

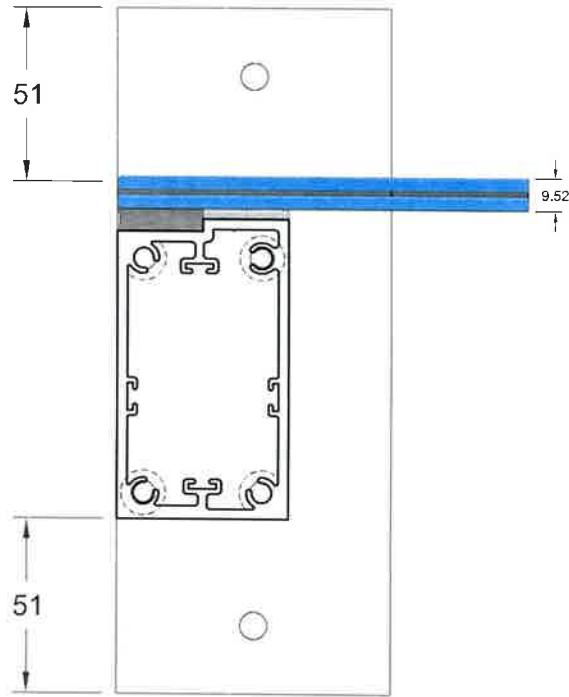
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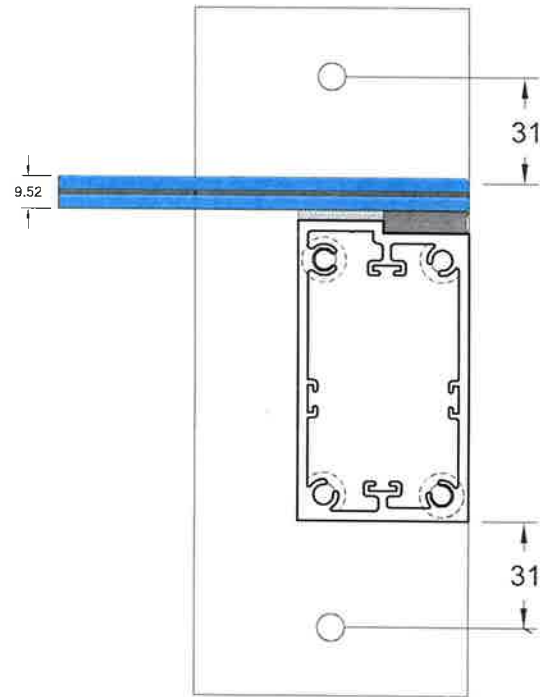
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			Open Air-Altered Solution	Sheet 10/ 11

ΑΡΙΣΤΕΡΟ



ΔΕΞΙ



Scale 1:2

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Σελίδα 2 από 2

<b>ALUMINCO</b> ALUMINIUM BUILDING SYSTEMS		<b>E2200-170</b>
Σχεδίαση	Γρηγόρης Παπαδήμος	Revision
Ημερομηνία	22-10-2015	22-10-2015
Ονομασία	Πέλμα στήριξης L&R για Open Air	20-11-2015
Υλικό	Απο προφίλ PAT39-074	05-01-2017
Προμηθευτής	Laser Aluminco	

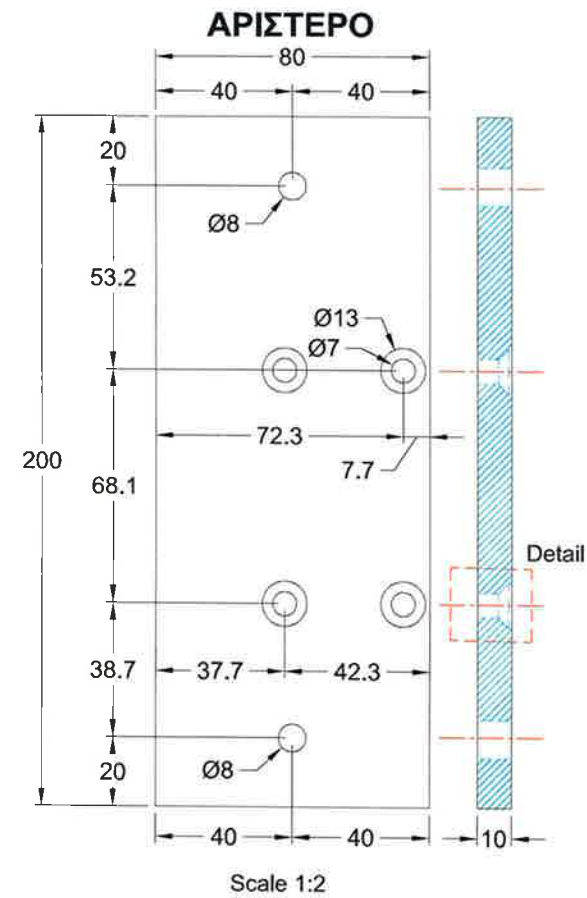
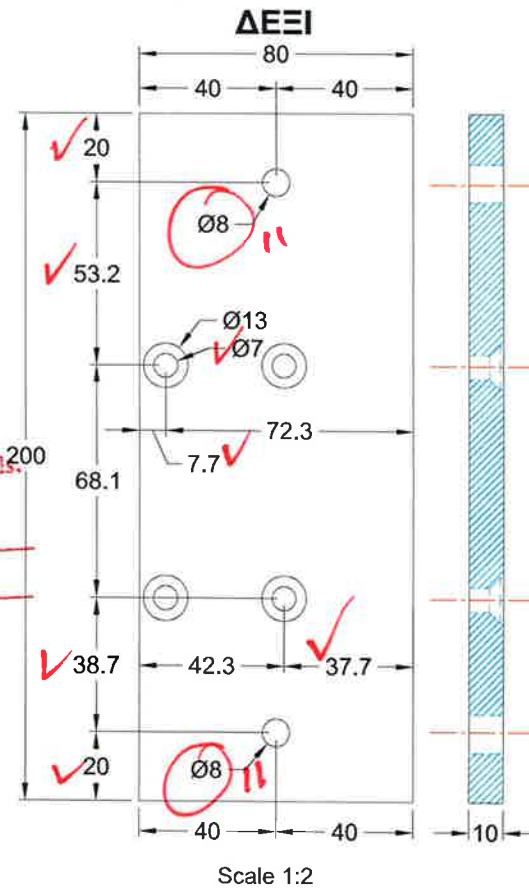
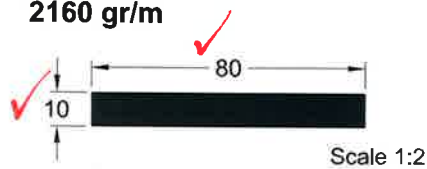
**ΠΕΛΜΑ ΣΤΗΡΙΞΗΣ OPEN AIR**  
**ΔΕΞΙ-ΑΡΙΣΤΕΡΟ (Ζευγάρι)**

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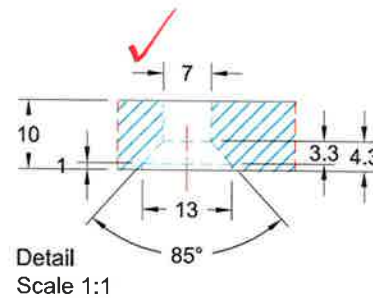
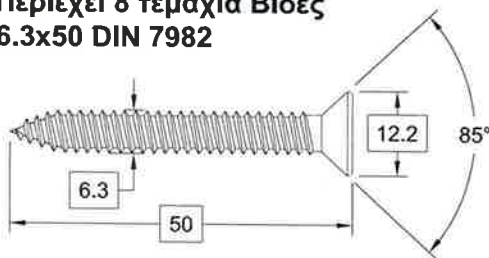
Test sample complies with these details.  
 Deviations are noted.

Report # H6052.01  
 Date 2/22/18 Tech CAK

Από προφίλ **PAT39-074**  
**2160 gr/m**



Περιέχει 8 τεμάχια Βίδες  
**6.3x50 DIN 7982**



<b>ALUMINCO</b> ALUMINIUM BUILDING SYSTEMS		<b>E2200-170</b>
Σχεδίαση	Γρηγόρης Παπαδήμος	Revision
Ημερομηνία	22-10-2015	22-10-2015
Ονομασία	Πέλμα στήριξης L&R για Open Air	20-11-2015
Υλικό	Απο προφίλ PAT39-074	05-01-2017
Προμηθευτής	Laser Aluminco	



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**TEST REPORT FOR ALUMINCO S.A.**

Report No.: H6052.01-119-19-R0

Date: 03/19/18

**SECTION 12**

**REVISION LOG**

REVISION #	DATE	PAGES	REVISION
0	03/19/18	N/A	Original Report Issue