

ALUMINCO S.A.

TEST REPORT

SCOPE OF WORK

STRUCTURAL PERFORMANCE TESTING ON *CRYSTALLINE L-LINE TOP MOUNT F85-1B62 GLASS*
BALUSTRADE SYSTEM

REPORT NUMBER

I0411.01-119-19-R0

TEST DATE(S)

12/13/17 - 01/25/18

ISSUE DATE

03/19/18

RECORD RETENTION END DATE

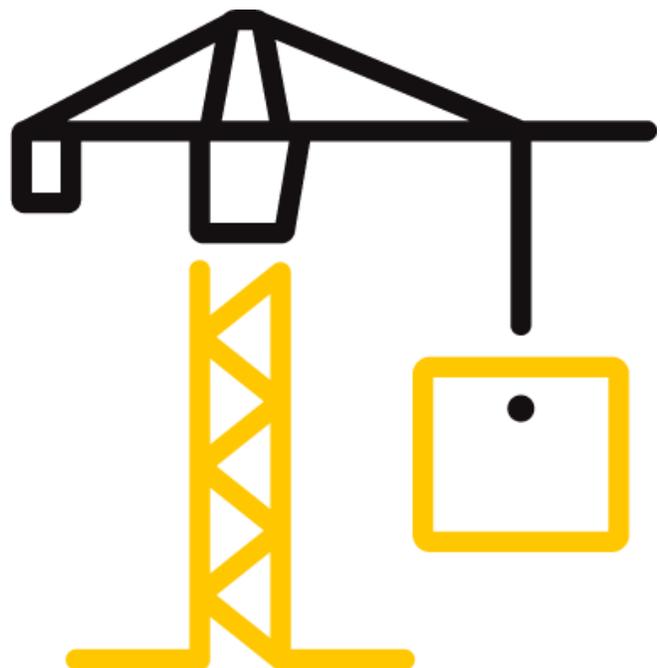
01/25/22

PAGES

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DOCUMENT CONTROL NUMBER

ATI 00642 (07/26/17)
RT-R-AMER-Test-2846
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TEST REPORT FOR ALUMINCO S.A.

Report No.: I0411.01-119-19-R0

Date: 03/19/18

REPORT ISSUED TO

ALUMINCO S.A. ENGINEERING DIVISION

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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 *Crystalline L-Line Top Mount F85-1B62* glass balustrade system. 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:

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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*[®], International Code Council

2015, *International Residential Code*[®], 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 for use in configurations with three or more panels. For use in less than 3-Panel configurations, additional testing would be required. The test specimens evaluated included the glass panels and mounting shoes. 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.

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 glass balustrade system was tested in a self-contained structural frame designed to accommodate anchorage of the base rail assembly to steel mounting 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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LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Christos Palaiologos	Aluminco S.A.
Michail Gerantzopoulos	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 balustrade assembly was installed and tested as a single panel section by directly securing (surface-mounting) the mounting shoe to a rigid steel test frame. The balustrade 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. All loads were applied from the interior side of the balustrade unless otherwise specified.

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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TEST SPECIMEN DESCRIPTION

The *Crystalline L-Line Top Mount F85-1B62* balustrade system consisted of extruded aluminum support shoes with glass panels. The glass panels were 39-1/4 in long with an overall rail height (deck surface to top of top rail) of 52-1/2. 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.

PRODUCT	<i>Crystalline L-Line Top Mount F85-1B62</i>
TYPE	Aluminum and glass guardrail system
OVERALL DIMENSIONS	39-1/4 in wide by 52-1/2 in high
GLASS PANELS	7/8 in thick laminated glass constructed from two sheets of 3/8 in thick clear tempered glass and an 0.060 in thick interlayer
GLASS CARRIAGE	Two-piece extruded aluminum, secured in place with two 0.31 in O.D. set screws
MOUNTING SHOE	3 in wide by 5 in high U-shaped aluminum extrusion with a 2-7/8 in wide mounting flange

Fastening Schedule

GLASS PANEL TO MOUNTING SHOE	Set onto glass carriages and secured in place with plastic wedge shims located on the interior side of the glass and flat plastic shims on the exterior side of the glass. A kerf-mounted rubber gasket was used on the exterior leg of the mounting shoe and a snap-fit aluminum cover with a kerf mounted rubber fin was used on the interior of the mounting shoe
MOUNTING SHOE TO STEEL FIXTURE	M12 hex head bolt, washer, and nut, located 5 in from each end and spaced 10 in on center

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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 - 12/13/17

DESIGN LOAD: 50 lb / 1 Square ft at Bottom of In-fill

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	MAX DISPLACEMENT (in)
Initial Load	10	00:00	0.00
2.0x Design Load	100	01:18	0.04
Initial Load	10	03:09	0.04
0% Recovery from 2.0 x Design Load			
4.0x Design Load	200	03:55	Achieved Load without Failure

TEST NO. 2 - 01/25/18

DESIGN LOAD: 200 lb Concentrated Load at Top Corner of Glass Panel

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	MAX DISPLACEMENT (in)
Initial Load	38	00:00	0.00
2.0x Design Load	401	01:29	3.77
Initial Load	40	04:58	0.25
93% Recovery from 2.0 x Design Load			
4.0x Design Load	801	08:08	Achieved Load without Failure

¹ Net displacement was the top rail displacement relative to its ends.

Test No. 3 - 12/13/17

DESIGN LOAD: 200 lb Concentrated Load at Top Corner of Glass Panel (Vertical)

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	MAX DISPLACEMENT (in)
Initial Load	40	00:00	0.00
2.0x Design Load	401	00:59	0.00
Initial Load	41	02:32	0.00
100% Recovery from 2.0 x Design Load			
4.0x Design Load	804	03:32	Achieved Load without Failure

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Test No. 4 - 01/26/18

**DESIGN LOAD: 200 lb Concentrated Load at Top Corner of Glass Panel
(Applied from Exterior Side)**

LOAD LEVEL	TEST LOAD (lb)	E.T. (min:sec)	MAX DISPLACEMENT (in)
Initial Load	40	00:00	0.00
2.0x Design Load	400	01:31	5.33
Initial Load	41	05:22	0.22
96% Recovery from 2.0 x Design Load			
4.0x Design Load	804	08:09	Achieved Load without Failure

SECTION 9

CONCLUSION

The test results substantiate compliance with the design load and safety factor requirements of the referenced building codes for the 39-1/4 in wide by 52-1/2 in high balustrade (*Crystalline L-Line Top Mount F85-1B62*) reported herein. The system is limited to use in configurations consisting of three or more panels. Anchorage of support posts to the supporting structure is not included in the scope of this testing and would need to be evaluated separately.

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SECTION 10 PHOTOGRAPHS



Photo No. 1
In-Fill Load Test at Bottom of Infill



Photo No. 2
Concentrated Load at Top Corner of Glass Panel

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Photo No. 3

Concentrated Load Test at Top Corner of Glass Panel (Applied from Exterior Side)



Photo No. 4

Concentrated Load Test at Top Corner of Glass Panel (Vertical)



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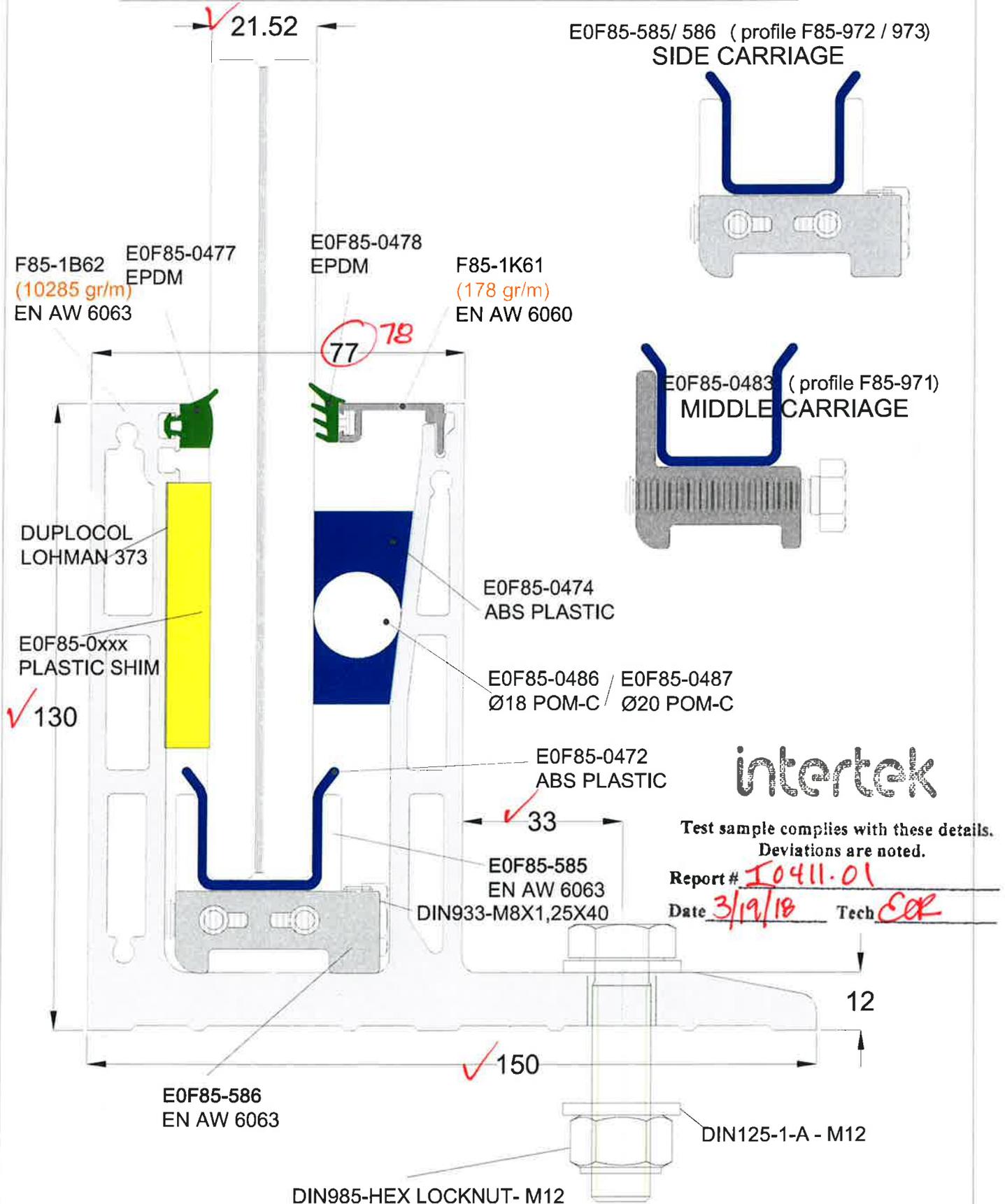
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SECTION 11 DRAWINGS

The drawings for the *Crystalline L-Line Top Mount F85-1B62* glass balustrade 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.

CRYSTALLINE L-LINE TOP MOUNTED GLASS 10-4PVB-10MM





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SECTION 12

REVISION LOG

REVISION #	DATE	PAGES	REVISION
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