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Bellaterra : May 12, 2025

File number : **25/32302364**

Petitioner's Reference : **ALUMINIOS CORTIZO, S.A.**
CIF: A15077761
C/ Extramundi, s/n
15901 – Padron (A CORUÑA)

TEST REPORT

Sample No.: 25-31594

1.- PRODUCT TESTED:

A guard railing to prevent falls, for permanent use in building work formed by a lower extruded aluminium section that must be **anchored over slab**, a double glazed laminated glass pane inserted in the metal section and the appropriate wedges to ensure the rigidity of the system. Glass panes of different thicknesses and compositions may be inserted in the system. **For the test have been used units of tempered laminated glass 8+8.2** as well as fasteners for concrete slabs, according to catalogue

The tested sample was delivered to the premises of APPLUS-Bellaterra and installed by the Petitioner.

The comercial name of the model in question is:

Railing front forged in Y - COR-8535

2.- TESTS REQUESTED:

2.1.-) Verification of the mechanical behavior under a horizontal outward thrust according to the Spanish Technical Building Code (CTE) Basic Document of Safety of Use and Accessibility, Section SUA 1 Safety against the risk of falls, Section 3.2 Difference in level, characteristics of the railings, Subsection 3.2.2, applying a thrust force indicated by the petitioner of **0,8 kN/m**, based on table 3.3 of section 3.2.1 of the DB SE-AE of the CTE.
Next, that same force will be applied by applying the partial safety factor of 1,5 for actions of variable resistance, as indicated in table 4.1 of section 4.2.4 of the CTE DB-SE.

2.2.-) In addition, the load of 1.0 kN/m shall be verified to cover the loads included in Eurocode 1, actions in structures (UNE-EN 1991-1-1:2003/AC:2010) in table 6.12 for the categories of use where a resistance ≤1.0 kN/m is required.

2.3.-) On the other hand, the following tests have also been requested according to the UNE 85-238-91 standard: Railings. Test methods:

- Horizontal static test to the outside
- Horizontal static test to the inside
- Dynamic test with soft body
- Dynamic test with hard body

The results reflected in this report refer only to the sample received at LGAI and tested under the conditions indicated in the standards or test methods cited in this document. LGAI Technological Center,S.A. is not responsible for the documentation provided by the petitioner.

Declaración Responsable de LGAI Technological Center, S.A., con Nº Inscripción L0600386, del R.D. 410/2010, D. 149/2017 y Ley 25/2009. Consulta: Laboratoris d'assaigs per al control de la qualitat de l'edificació. Habitatge (gencat.cat)

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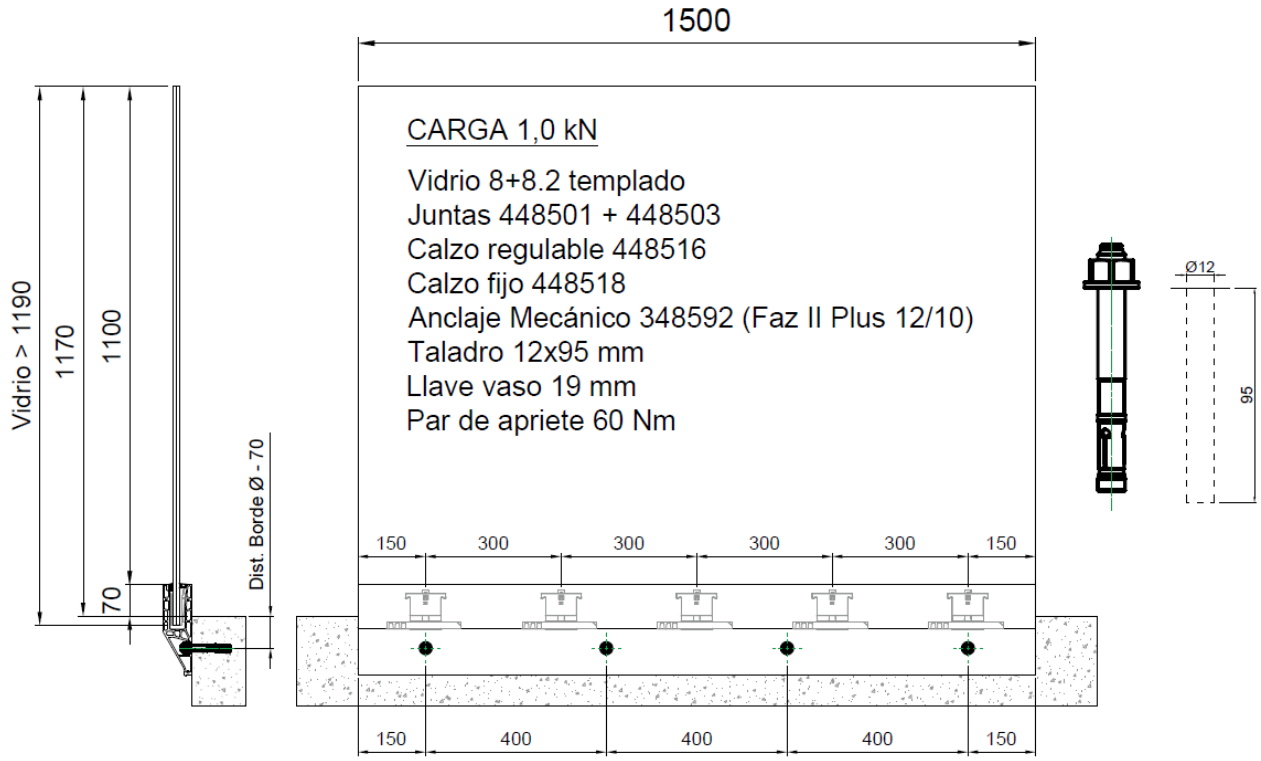
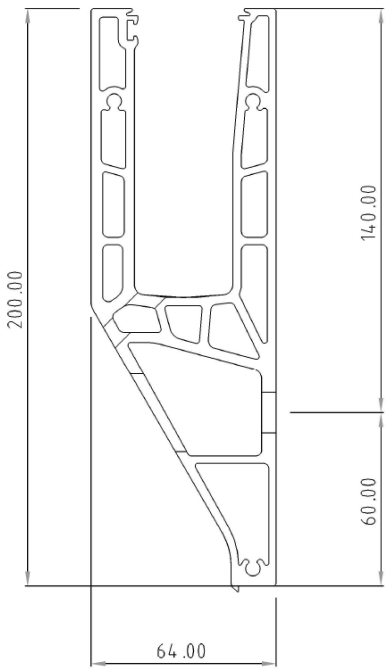
LGAI Technological Center S.A. Inscrita en el registro Mercantil de Barcelona, Tomo 35.803, Folio1, Hoja Nº B-266.627 Inscripción 1ª C.I.F. : A-63207492

3.- IDENTIFICATION OF THE RAILING PROVIDED BY THE PETITIONER

ENSAYO 7 Barandilla frente forjado en Y - COR-8535



COR-8535



4.- TESTS:

The tests will take place on April 10, 2025.

4.1.- Verification of the mechanical behavior under horizontal outward thrust according to the Technical Building Code (CTE).

The Technical Building Code (CTE) Basic Document on Safety of Use and Accessibility, Section SUA 1 Safety against the risk of falls, Section 3.2 Slopes, characteristics of protective barriers, Sub-section 3.2.2. Resistance, specifies that barriers must have a specific resistance category according to the area where they are located.

The same CTE, in the DB-SE-AE (Structural Safety, Actions in Buildings) specifies the categories of use summarized in the following table and the horizontal loads they must resist.

Category of Use		Subcategory of Use		Category of Use
A	Residential areas	A	Residential areas	0.8
		A2	Trasteros	0.8
B	Administrative areas			B
C	Public access areas (with the exception of areas belonging to categories A, B and D).	C	Public access areas (with the exception of areas belonging to	0.8
		C2	Zonas con asientos fijos	0.8
		C3	Zonas sin obstáculos que impidan el libre movimiento de las personas como vestíbulos de edificios públicos, administrativos, hoteles, salas de exposición en museos, etc.	1.6
		C4	Zonas destinadas a gimnasio u actividades físicas	1.6
		C5	Zonas de aglomeración (salas de conciertos, estadios, etc.)	3.0
D	Commercial areas	D	Commercial areas	0.8
		D2	Supermercados, hipermercados o grandes superficies	0.8
E	Traffic and parking areas for light vehicles (< 30kN)			E
F	Walkable roofs accessible only privately			F
G	Covers accessible only for conservation	G	Covers accessible only for conservation	0.8
			Cubiertas ligeras sobre correas (sin forjado)	
		G2	Cubiertas con inclinación superior a 40º	0.8

The railing is subjected to a linear load in kN/m, at the top and towards the outside for a time of 3 minutes and it is verified if there has been any disorder that affects its functionality or stability.

According to the CTE DB SE-AE apt. 3.2, the structure of the railings, parapets, parapets or railings of terraces, belvederes, balconies or stairs must resist a horizontal force, uniformly distributed, and whose value will be the one corresponding to its category and subcategory of use.

A load is then applied by applying the partial safety coefficient of 1,5 for actions of variable resistance, as indicated in table 4.1 of section 4.2.4 of the CTE DB-SE (Basic Document on Structural Safety), obtaining the following results:

OUTWARD HORIZONTAL THRUST **(Load of 0,8 kN/m = 1,2 KN)**	Deformation under load (mm): 93,5 mm Residual deformation (mm): 3,1 mm
	The railing has sufficient strength and stiffness to resist the uniformly distributed horizontal force applied to the top edge of the element.

The railing withstands a horizontal thrust of 0,8 kN/m

OUTWARD HORIZONTAL THRUST (Load 0,8 kN/m*1,5 = 1,2 kN/m = 1,8 kN)	Deformation under load (mm): 124,4 mm Residual deformation (mm): 0,9 mm
	The railing has sufficient strength and stiffness to resist the uniformly distributed horizontal force applied to the top edge of the element.

The railing withstands a horizontal thrust of 1,2 kN/m

A load of 1,0 kN/m is applied, to cover the loads listed in Eurocode 1, actions in structures (UNE-EN 1991-1-1:2003/AC:2010) in table 6.12 for the categories of use where a resistance ≤1,0 kN/m is required. See table of categories below.

Category	Specific use	Example
RESIDENTIAL, SOCIAL, COMMERCIAL AND ADMINISTRATIVE AREAS		
A	Areas of domestic and residential activities	Rooms in residential buildings and individual dwellings; bedrooms and corridors in hospitals; bedrooms in hotels and kitchens and toilets in hostels.
B	Office areas	
C	Areas where people can congregate (with the exception of areas defined under categories A, B and D).	C1: Areas with tables, etc., e.g. areas in schools, cafes, restaurants, canteens, reading rooms, receptions. C2: Areas with fixed seating, e.g. areas in churches, theaters or cinemas, conference rooms, assembly halls, meeting rooms, waiting rooms, railroad station waiting rooms. C3: Areas without obstacles to the movement of people, e.g. areas in museums, exhibition halls, etc., and access areas in public and administration buildings, hotels, hospitals, railroad station lobbies. C4: Areas with potential physical activities, e.g. dance halls, gymnasiums, stages. C5: Areas likely to gather large crowds, e.g. in buildings for public celebrations such as concert halls, sports halls including bleachers, terraces and access areas and train platforms.
D	Commercial areas	D1: Zones in retail stores D2: Zones in department stores
WAREHOUSING AND INDUSTRIAL ACTIVITIES AREAS		
E1	Areas likely to be used for the accumulation of goods, including access areas.	Storage areas including books and other documents.
E2	Industrial use	--
For categories A, B and C1 a load can be chosen from the values in the range 0,2 kN/m to 1,0 kN/m. For categories C2 to C4 and D a load can be chosen from the values in the range 0,8 kN/m to 1,0 kN/m. For category C5 a load can be chosen from the values in the range 3,0 kN/m to 5,0 kN/m. For category E a load can be chosen from the values in the range 0,8 kN/m to 2,0 kN/m.		

OUTWARD HORIZONTAL THRUST (Load of 1,0 kN/m = 1,5 KN)	Deformation under load (mm): 107,3 mm Residual deformation (mm): 1,1 mm
	The railing has sufficient strength and stiffness to resist the uniformly distributed horizontal force applied to the top edge of the element.

The railing withstands a horizontal thrust of 1,0 kN/m

4.2.- Tests according to UNE 85-238-91: railings. Test methods:

- ### 4.2.1.- Horizontal outward static test

The upper edge of the railing was submitted to an outward static stress higher than the normal stress in use.

The applied load requested by the Petitioner are:

- An global force of 1,3 kN, which will cover the requested usage load for private parking area locations <3,25m in length.
- A force of 1kN/m (equivalent to an overall force of 1,5 kN for a 1,5m long railing), which will cover the requested usage load for public places.

The load was applied for a period of 3 minutes and then the permanent deformation of the railing was measured 3 minutes after the load is removed.

The residual deformation after unloading must be less than or equal to 1 mm for ferrous materials and 3 mm for other materials.

OUTWARD HORIZONTAL THRUST **(overall load of 1,3 KN)**	Deformation under load (mm): 96,8 mm Residual deformation (mm): 1,2 mm
	The railing has sufficient strength and stiffness to resist the uniformly distributed horizontal force applied to the top edge of the element.

IT COMPLIES with the requirements of the UNE 85-238:91 standard, for private parking areas <3.25m in length.
(The railing withstands an overall load of 1,3 kN)

OUTWARD HORIZONTAL THRUST **(Load of 1,0 kN/m = 1,5 KN)**	Deformation under load (mm): 107,3 mm Residual deformation (mm): 1,1 mm
	The railing has sufficient strength and stiffness to resist the uniformly distributed horizontal force applied to the top edge of the element.

IT COMPLIES with the requirements of the UNE 85-238:91 standard, for public places.
(The railing withstands a load of 1,0 kN/m)

- **4.2.2.- Horizontal inward static test**

The railing is subjected to a horizontal static stress exerted at the level of the top rail and in the center, inward.

The overall load of 0,4 kN (0,4 kN per crosshead) is exerted for 1 minute. Once the load is removed, the residual deformation "a" is measured and its value must satisfy the equation:

"a"<15X/1000

Where X is the distance between the top of the handrail and the anchor point of the handrail (in this case = 1170mm)

Therefore, it must comply with a <15x1170 /1000 = 17,5mm

HORIZONTAL INWARD THRUST **(Load of 0,4 kN)**	Deformation under load (mm): 23,3 mm Residual deformation (mm):1,9 mm
	The railing under load of use does not present disorder susceptible to affect its functionality or stability.
IT COMPLIES with the requirements of the UNE 85-238:91 standard. **(The railing withstands a load of 0,4 kN/m)**	

- **4.2.3.- Dynamic test with soft body**

The test consists of subjecting the filling element (in this case glass) to the impact action defined in section 9.2.3 of the UNE 85-238-91 standard with a large soft body. For the impact, a spherocone bag with a mass of 50 kg is used.
The impact energy must be 600J (0.5kN x 1.20m).
The impact is made on the inside of the element and the impact must hit the geometrical center of the filling element.

SOFT BODY DYNAMIC TEST ON THE FILLING ELEMENT, AT THE GEOMETRICAL CENTER	
Benefit requirement	
There shall be no falling pieces or elements that could cause bodily injury to people outside.	**Passes the test**
For railings with one or more plates on the infill element, the surface of the broken part must not allow the tester to pass through. In addition, the infill element must not be detached from the guardrail frame.	**Passes the test**
IT COMPLIES with the requirements of the UNE 85-238:91 standard.	

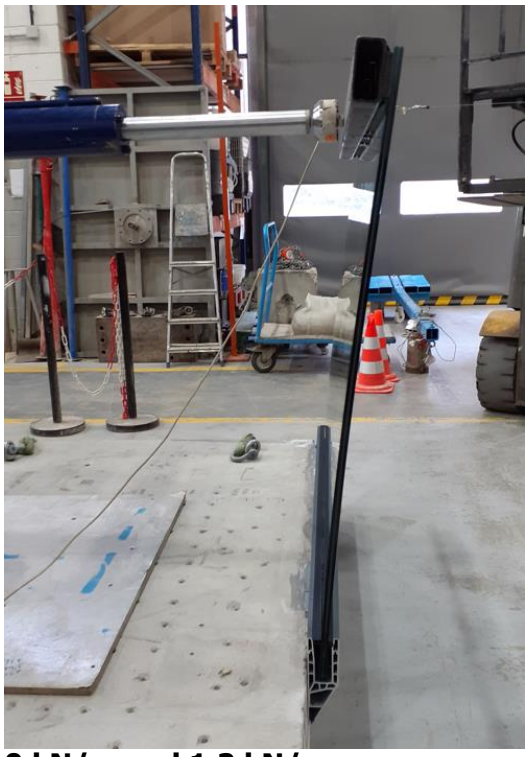
- **4.2.4.- Dynamic test with hard body**

It consists of subjecting the filling element (in this case glass) to the impact action of a solid steel hard body of 0,5 kg mass and 50 mm diameter. The impact energy must be 3.75 J (0,005kN x 0,75m).
The impact must be at the geometric center of the filling element. The diameters of the footprints created and whether or not there is fracture are noted.

DYNAMIC HARD BODY TEST ON THE FILLiNG ELEMENT, AT THE GEOMETRICAL CENTER	
Benefit requirement	
There shall be no falling pieces or elements that could cause bodily injury to people outside.	**Passes the test**
For guardrails with one or more plates on the infill element, the surface of the broken part must not allow the tester to pass through. In addition, the infill element must not be detached from the guardrail frame.	**Passes the test**
IT COMPLIES with the requirements of the UNE 85-238:91 standard.	

PHOTOGRAPHIES:

Outward horizontal thrust 0,8 kN/m and 1,3 kN



Outward horizontal thrust 1,0 kN/m and 1,2 kN/m

Inward horizontal thrust of 0,4 kN

Soft body impact

CONCLUSIONS

The tested railing withstands the horizontal thrust of 0,8 kN/m of the Spanish Technical Building Code (CTE) *Basic Document on Safety in Use and Accessibility, Section SUA 1 Safety against the risk of falls, Section 3.2 Slopes, characteristics of protective barriers, sub-section 3.2.2, for the following uses:*

- A: Residential areas
- B: Administrative areas
- C1 and C2: Public access areas (with the exception of areas belonging to categories A, B and D).
- D: Commercial areas
- G: roofs accessible only for maintenance

It also supports the partial safety coefficient of 1,5 for actions of variable resistance, as indicated in table 4.1 of section 4.2.4 of the CTE DB-SE (Basic Document on Structural Safety).
For each work, the necessary loads defined in each project should be taken into account, where the exposure and wind coefficients should be considered.

The railing tested supports the horizontal thrust according to the specifications of Eurocode 1, actions on structures (UNE-EN 1991-1-1:2003/AC:201) indicated in table 6.12, for the categories of use where a resistance ≤ 1,0kN/m is required:

- *A: Zones of domestic and residential activities.*
- *B: Office areas*
- *C1 to C4: Areas where people may congregate (with the exception of areas defined under categories A, B and D).*
- *D: Commercial areas*
- *E1 (up to 1,0 kN/m): Areas likely to be used for the accumulation of goods, including access areas.*
- *E2 (up to 1,0 kN/m): Industrial use.*

The railing tested it complies the following tests according to the UNE 85-238-91 standard

- *Horizontal static test to the outside:*
- *for private places of parking area length <3,25m.*
- *for public places*
- *Horizontal static test to the inside*
- *Dynamic test with soft body*
- *Dynamic test with hard body*

Firmado digitalmente por JUAN MARTINEZ EGEA

Construction Materials Manager
LGAI Technological Center S.A.

Firmado digitalmente por MANUEL LUQUE GAMA

Responsible Technician
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