

TEST REPORT No. 337961

Place and date of issue: Bellaria-Igea Marina - Italia, 24/11/2016

Customer: REGAL ALÜMINYUM KÜPESTE AKS. SAN. TIC. LTD. STI - Emek Mah. Sivat Yolu Cad. No:2 -
34785 SANCAKTEPE/ISTANBUL - Turkey

Date test requested: 20/10/2016

Order number and date: 71310, 21/10/2016

Date sample received: 04/11/2016

Test date: 14/11/2016

Purpose of test: resistance to horizontal static loading in accordance with standard NF P01-013:1988 and resistance to dynamic impact with a 50 kg soft body in accordance with standard NF P08-301:1991 of a railing

Test site: Istituto Giordano S.p.A. - Via Erbosa, 72 - 47043 Gatteo (FC) - Italia

Origin of sample: sampled and supplied by the Customer

Identification of sample received: No. 2016/2236

Sample name*

The test sample is called "REGAL ALUMINIUM SQUARE OVAL HORIZONTAL RAILING SYSTEM".

(*) according to that stated by the Customer

Comp. AV
Revis. PB

This test report consists of 8 sheets.

Sheet
1 of 8

Description of sample*

The test sample consists of an aluminum railing and handrail with the following characteristic:

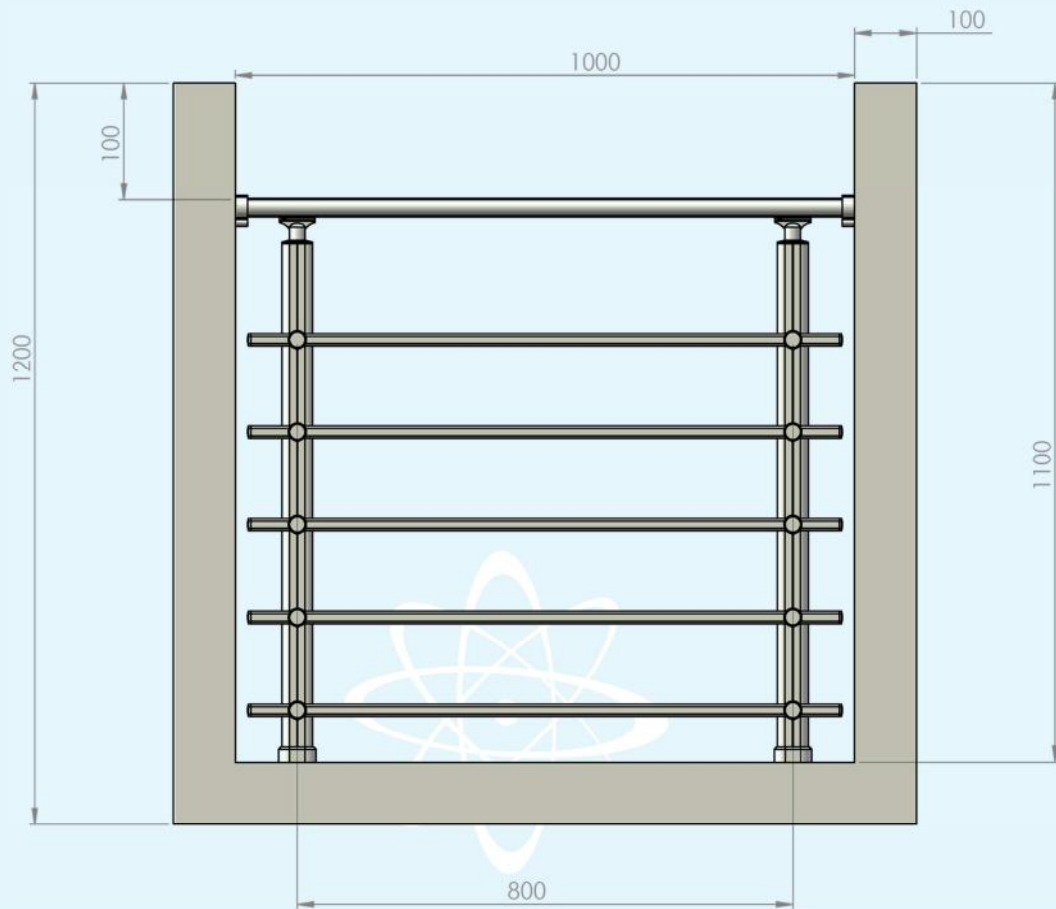
- measured overall width = 1000 mm;
- overall height = 1000 mm.

Further details of sample technical specifications can be seen in Customer-supplied schematic drawings shown hereafter.



Photos of the sample

(*) according to that stated by the Customer

SAMPLE SCHEMATIC DRAWING**Customer-supplied list of components**

| Code | Description | Quantities |
|----------|--|------------|
| RGL-7005 | 50 mm × 50 mm semi-circular set with joint | 2 pcs |
| RGL-7207 | 50 mm × 50 mm perpendicular flange | 2 pcs |
| RGL-9901 | Anchor | 2 pcs |
| RGL-7613 | 20 mm × 20 mm holder of the impost | 10 pcs |
| RGL-7305 | 80 mm × 30 mm wall connection accessory | 2 pcs |
| RGL-7557 | 20 mm × 20 mm end cap | 10 pcs |
| RGL-35-A | 80 mm × 30 mm profile | 1 m |
| RGL-39-A | 50 mm × 50 mm profile | 2 m |
| RGL-23-A | Cover for 50 mm × 50 mm profile | 2 m |
| RGL-38-A | 20 mm × 20 mm profile | 10 m |

Normative references

The test was carried out in accordance with the requirements of the following standards:

- NF P01-013:1988 dated August 1988 “Essais des garde-corps. Méthodes et critères” (“*Railing tests. Methods and criteria*”);
- NF P08-301:1991 dated April 1991 “Ouvrages verticaux des constructions - Essais de résistance aux chocs - Corps de chocs - Principe et modalités générales des essais de choc” (“*Vertical building elements - Impact resistance tests - Impact bodies - Impact test principle and general methods*”).

Test apparatus

Resistance to static loading

The following equipment was used to carry out the resistance to static loading test:

- steel frame simulating actual installation of the sample on the floor (apparatus in-house identification code EDI048);
- set of steel masses for static load test;
- Mitutoyo IDF Digimatic Indicator complete with calibration report issued by Istituto Giordano S.p.A.;
- AEP Transducers 100 kg load cell (apparatus in-house identification code EDI107);
- metric ruler (apparatus in-house identification code EDI083);
- digital thermo-hygrometer (apparatus in-house identification code EDI111).

Resistance to dynamic load

The test was performed using a sphero-conical bag, diameter 400 mm and height 600 mm, filled with hardened solid glass spheres, diameter 3 mm, until reaching 50 kg overall mass, and suspended by an in-extensible cable of negligible mass so that when hanging at rest it makes contact with the sample at the desired point of impact.

Test method

The sample, secured both to the floor and to the sides, was subjected to the following test.

Outward horizontal static loading

With just underside secured to the floor, the sample was subjected to a load distributed uniformly over two points on the handrail in accordance with figure 1 “Garde-corps sans potelets, ancrés au niveau de l’appui” (*“Railings without posts anchored at the base”*) of standard NF P01-013:

- preload of 1,3 kN applied gradually until reaching the present value and maintained for 3 min;
- removal of load and resetting of gauge;
- horizontal static load of 1,3 kN applied gradually until reaching the present value and maintained for 60 s, following which deflection whilst loaded was measured;
- removal of load and recording of permanent deflection after 3 min and verification of permissible permanent deflection “a” in mm, following removal of safety load using the following equation:

$$a \leq 3$$

- horizontal static safety load of 2,21 kN with coefficient of 1,7 for aluminium, applied and maintained for 5 min, following which deflection whilst loaded was measured;
- removal of load and recording of permanent deflection after 3 min and verification of permissible permanent deflection “a” in mm following removal of safety load using the following equation:

$$a \leq \frac{8 \cdot X}{1000}$$

where: X=height of sample from fixing point in mm.

Resistance to dynamic loading

With just underside secured to the floor, the sample was subjected to a dynamic load with energy of 600 J (0,50 kN × 1,20 m).

All impacts were made by releasing the impactors so that they fall from a specified height with a pendulum movement and without initial velocity. The impactors were hung by an inextensible pendulum wire of negligible mass so that when at rest they made contact with the point of intended impact. After each impact, the impactors were prevented from hitting the sample again after bouncing.

Environmental conditions at the time of testing

| | |
|--------------------------|---------------|
| Room temperature | (15,8 ± 2) °C |
| Relative humidity | (59 ± 5) % |

Test results

Resistance to outward horizontal static loading of handrail

| Applied load (clause 2.2.1.2 of standard NF P01-013) [kN] | Deflection whilst loaded [mm] | Permanent deflection [mm] | Maximum permanent deflection** [mm] | Result |
|---|---|---|---|---------------|
| 1,30 | 1,62 | 0,66 | 3 | pass |
| 2,21* | 3,72 | 0,66 | 8 | pass |

(*) safety load with coefficient of 1,7 for aluminium.

(**) permissible permanent deflection "a" calculated in accordance with 2.2.1.2.4 "Déformation admissible des garde-corps métalliques" ("Permissible deflection of metal railings") of standard NF P01-013.

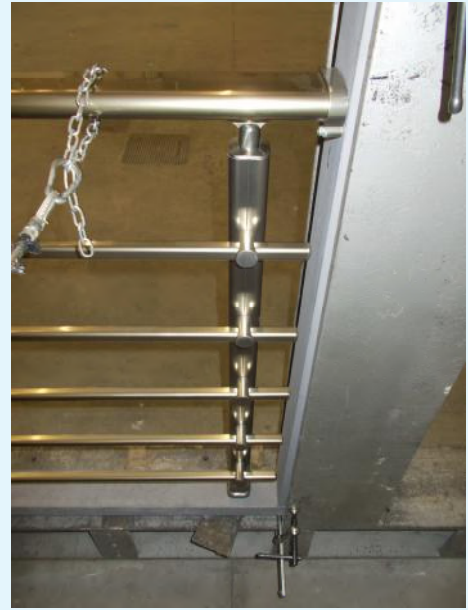
Resistance to dynamic load

| Impact area | Drop height [m] | Energy [J] | Result |
|--------------------|---------------------------|----------------------|---------------|
| centre of infill | 1,2 | 600 | no damage* |

(*) No falling fragments that could cause personal injury were found below.

No gaps were formed between the bars of sufficient size to allow the passage of the gauge specified in figure 7 of standard NF P01-013.

No sample performance loss compared to design specifications was witnessed.



Photographs of the sample during resistance to horizontal static loading test



Photographs of the sample before and after impact

Findings

According to the test performed, according to the results obtained and according to what indicated in standard NF P01-013, the test sample, consists of an aluminum railing and handrail, called "REGAL ALUMINIUM SQUARE OVAL HORIZONTAL RAILING SYSTEM" and presented by the company REGAL ALÜMINYUM KÜPESTE AKS. SAN. TIC. LTD. STI - Emek Mah. Sivat Yolu Cad. No:2 - 34785 SANCAKTEPE/ISTANBUL - Turkey, is:

| Test | Use | Result |
|-------------------------------------|-------------------|-----------|
| Outward horizontal static loading | Public (1,0 kN/m) | Compliant |
| Outward horizontal static loading | Private (1,3 kN) | Compliant |
| Dynamic impact with 50 kg soft body | // | Compliant |

The results given refer exclusively to the test sample itself and are only valid under the same conditions in which testing was carried out.



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