



Project No.: 190502

Date: December 3rd, 2019

Fortress Building Products

1720 North 1st Street
Garland, Texas, USA 75020

Attn: Stuart Rosenfield, Product Manager, (stuartr@fortressbp.com)

Dear: Mr. Rosenfield;

Re: Review of Intertek Test Report for "AL13", "AL13 HOME", and "FE26" Components
Intertek Report Number: J7912.01-119-19 R1
Intertek Document Control Number: RT-R-AMER-Test-2846 (02/09/18)
Products Tested: AL13, AL13 Home, and FE26 Components

Steenhof Building Services Group (SBSG) was retained by Fortress Building Products to perform a review of Intertek's structural load tests conducted on the *AL13*, *AL13 Home* and *FE26* structural components for a metal guard. We understand that you require independent third-party verification that the tested metal posts and brackets can withstand the prescribed loads in the following Canadian standards:

1. **National Building Code of Canada 2015 (NBCC)**
2. **Ontario Building Code 2012, Revision 2015 (OBC)**
3. **Alberta Building Code 2014 (ABC)**
4. **British Columbia Building Code 2018 (BCBC)**

The findings of the tests are presented in the Intertek test report number J7912.01-119-19 R1 dated December 2nd, 2019. The extent of the test included load testing on cantilevered aluminum posts as well as the top-mounted and side-mounted brackets. Connection of the supports to the supporting steel and concrete structures was not included.

The report indicated the *AL13 and AL13 Home* posts as well as the matching *FE26* brackets and top-mounted post base were tested. All products were tested with the load in the horizontal direction only. Loads in excess of the prescribed loads in the building codes were applied and deflection measurements were recorded at 90% of the specified 224lbf (1.0kN) in the Codes.

The 3" *AL13* posts and associated *FE26* brackets were tested to failure to loads in excess of 1,550 lbf with a deflection of 0.98". This represented the most extreme case. In addition to the above tests, the performance of the *FE26* brackets was evaluated for the in-line, outside corner, and inside corner variants. The same test was repeated to failure for the 2" and 3" *AL13 Home* Posts, matching *FE26* Brackets, and the top-mounted post base.

The test results indicated the specimens tested were able to withstand only some of the prescribed loads in Part 4 of all provincial codes and the national code. The above listed provincial codes share the exact same loads that are listed in Subsection 4.1.5.14: Loads on Guards and Handrails in the NBCC. The specimens were tested in excess of the loads specified in Sentences 1(c) and 7(a) and (b) in Clause 4.1.5.14. An excerpt from the relevant Subsection is provided below.

4.1.5.14. Loads on Guards and Handrails

(See Note A-4.1.5.14 and 4.1.5.15.(1).)

- 1) *The minimum specified horizontal load applied outward at the minimum required height of every guard shall be*
 - a) *3.0 kN/m for open viewing stands without fixed seats and for means of egress in grandstands, stadia, bleachers, and arenas,*
 - b) *A concentrated load of 1.0 kN applied at any point, so as to produce the most critical effect, for access ways to equipment platforms, contiguous stairs and similar areas where the gathering of many people is improbable, and*
 - c) *0.75 kN/m or a concentrated load of 1.0 kN applied at any point so as to produce the most critical effect, whichever governs for locations other than those described in Clauses (a) and (b).*
- 2) *The minimum specified horizontal load applied inward at the minimum required height of every required guard shall be half that specified in Sentence (1).*
- 3) *Individual elements within the guard, including solid panels and pickets, shall be designed for a load of 0.5 kN applied outward over an area of 100mm by 100mm located at any point in the element or elements so as to produce the most critical effect.*
- 4) *The size of the opening between any two adjacent vertical elements within a guard shall not exceed the limits required by Part 3 when each of these elements is subjected to a specified live load of 0.1 kN applied in opposite directions in the in-plane direction of the guard so as to produce the most critical effect.*
- 5) *The loads required in Sentence (3) need not be considered to act simultaneously with the loads provided for in Sentences (1), (2), and (6).*
- 6) *The minimum specified load applied vertically at the top of every required guard shall be 1.5 kN/m and need not be considered to act simultaneously with the horizontal load provided for in Sentence (1).*
- 7) *Handrails and their supports shall be designed and constructed to withstand the following loads, which need not be considered to act simultaneously:*
 - a) *A concentrated load not less than 0.9 kN applied at any point and in any direction for all handrails, and*
 - b) *A uniform load not less than 0.7 kN/m applied in any direction to handrails not located within dwelling units.*

It should be noted that the specified loads in Sentences 1 (a) and 6 in Subsection 4.1.5.14. do not apply since the posts and brackets were not tested at this level.

Furthermore, the test results indicated the tested specimens were able to withstand the prescribed loads in Part 9 of all the provincial codes examined, which share the exact same loads that are listed in Subsection 9.8.8.2: Loads on Guards in the NBCC.

The following is an excerpt from Part 9 of the National Building Code of Canada, Volume 1.

9.8.8.2. Loads on Guards

(See Note A 9.8.8.2.)

- 1) Except as provided in Sentences (2) and (4), guards shall be designed to resist the specified loads prescribed in Table 9.8.8.2.

| Table 9.8.8.2. | | | |
|---|---|--|---|
| Specified Loads on Guards | | | |
| <i>Forming Part of Sentence 9.8.8.2.(1)</i> | | | |
| <i>Location of Guard</i> | <i>Minimum Design Load</i> | | |
| | <i>Horizontal Load Applied Inward or Outward at any Point at the Minimum Required Height of the Guard</i> | <i>Horizontal Load Applied Outward on elements Within the Guard, Including Solid Panels and Balusters</i> | <i>Evenly Distributed Vertical Load Applied at the Top of the Guard</i> |
| <i>Guards within dwelling units and exterior guards serving not more than 2 dwelling units</i> | <i>0.5 kN/m (34 lbf/ft) or a concentrated load of 1.0 kN (224 lbf) applied at any point ⁽¹⁾</i> | <i>0.5 kN (112 lbf) applied over a maximum width of 300mm (11 ¾") and a height of 300mm (11 ¾") ⁽²⁾</i> | <i>1.5 kN/m (103 lbf/ft)</i> |
| <i>Guards serving access ways to equipment platforms and similar areas where the gathering of many people is improbable</i> | <i>Concentrated load of 1.0 kN (224 lbf) applied at any point</i> | <i>Concentrated load of 0.5 kN (112 lbf) applied at any point on individual elements</i> | <i>1.5 kN/m (103 lbf/ft)</i> |
| <i>All other guards</i> | <i>0.75 kN/m (52 lbf/ft) or a concentrated load of 1.0 kN (224 lbf) applied at any point ⁽¹⁾</i> | <i>Concentrated load of 0.5 kN (112 lbf) applied at any point on individual elements</i> | <i>1.5 kN/m (103 lbf/ft)</i> |
| <i>Column</i> | <i>1</i> | <i>2</i> | <i>3</i> |

Notes to Table 9.8.8.2.:

- (1) The loads that creates the most critical condition shall apply.
 (2) See Sentence (2).

- 2) For guards within dwelling units and within houses with a secondary suite including their common spaces and for exterior guards serving not more than 2 dwelling units, where the width and spacing of balusters are such that 3 balusters can be engaged by a load imposed over a 300mm width, the load shall be imposed so as to engage 3 balusters.
 3) None of the loads specified in Table 9.8.8.2. need be considered to act simultaneously.
 4) For guards within dwelling units and within houses with a secondary suite including their common spaces and for exterior guards serving not more than 2 dwelling units, Table 9.8.8.2. need not apply where the guard construction used has been demonstrated to provide effective performance.

9.8.8.3. Height of Guards

(See Note A-9.8.8.3.)

- 1) Except as provided in Sentences (2) to (4), all guards shall be not less than 1,070 mm high.
 2) All guards within dwelling units or within houses with a secondary suite including their common spaces shall be not less than 900mm high.
 3) Exterior guards serving not more than one dwelling unit or a house with a secondary suite including their common spaces shall be not less than 900mm high where the

walking surface served by the guard is not more than 1,800mm above the finished ground level.

- 4) Guards for flights of steps, except in required exit stairs, shall not be less than 900mm high.
- 5) The height of guards for flights of steps shall be measured vertically from the top of the guard to a line drawn through the tread nosing served by the guard.

9.8.8.5. Openings in Guards

- 1) Except as permitted by Sentences (2) and (3), openings through guards shall be of a size that prevents the passage of a spherical object having a diameter of 100mm. (See Note A-9.8.8.5.(1) and (2).)
- 2) Except where they serve storage garages, guards in industrial occupancies are permitted to consist of
 - a) A top railing, and
 - b) One or more horizontal intermediate rails spaced such that the size of the openings through the guard prevents the passage of a spherical object having a diameter of 535mm. (See Note A-9.8.8.5.(1) and (2).)
- 3) Openings through any guard that is not required by Article 9.8.8.1. and that serves an occupancy other than an industrial occupancy shall be of a size that
 - a) Prevents the passage of a spherical object having a diameter of 100mm, or
 - b) Permits the passage of a spherical object having a diameter of 200mm. (See Note A-9.8.8.5.(3).)

9.8.8.6. Design of Guards to Not Facilitate Climbing

- 1) Except for guards in industrial occupancies, guards required by Article 9.8.8.1. that protect a level located more than 4.2m above the adjacent level shall be designed so that no member, attachment, or opening located between 140mm and 900mm above the level protected by the guard facilitates climbing (See Note A-9.8.8.6.(1).)

Additionally, SBSG completed structural calculations regarding the strength and deflection of the posts and brackets. The calculations were carried out according to the known material properties of the Grade 6061-T6 aluminum post for yield strength (276MPa) and Modulus of Elasticity (68.9GPa). Our calculations confirm the metal posts and brackets are able resist the previously noted imposed live loads set out in Part 4 and Part 9 of the aforementioned Canadian Provincial and National Building Codes.

The maximum spacing of the posts shall not be exceeded for the type, size, and specified use as presented in Section 9 of the sealed Intertek Report.

Guards/Railings/Balustrades are unique for each project. The use of this post and bracket system in various buildings and project applications shall be reviewed by the Project Architect and Project Professional Engineer for conformance to all applicable codes and standards. Connection design of the brackets to a structurally adequate substrate shall be completed by a qualified design professional licensed to practice in their respective provinces.

Should you have any questions or comments please do not hesitate to contact us.

Sincerely,



STEENHOF Building Services Group
Griff Ferguson, B.A.Sc., P.Eng.
Structural Engineer



STEENHOF Building Services Group
Jack Steenhof, M.A.Sc., P.Eng.
President

