



ENGINEERING EVALUATION

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EVALUATION CENTER
Intertek Testing Services NA Ltd.
1500 Brigantine Drive
Coquitlam, BC V3K 7C1

RENDERED TO
EXCELL RAILING SYSTEM
#306 – 12886 ANVIL WAY
SURREY, BC V3W 8E7

PRODUCT EVALUATED:
Excell Welded Picket & Glass Railing System and Durarail Welded Picket & Glass Railing System
EVALUATION PROPERTY:
2006 International Building Code, Section 1607.7.1

Engineering Evaluation of Excell Welded Picket & Glass Railing System and Durarail Welded Picket & Glass Railing System for compliance with the applicable requirements of the following criteria: 2006 International Building Code, Section 1607.7.1

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1 Introduction

Intertek Testing Services NA Ltd. has conducted an engineering evaluation for Excell Railing System Ltd., on the Excell Welded Picket & Glass Railing System and Durarail Welded Picket & Glass Railing System, to evaluate the interchangeability of 2 respective types of top rails. The evaluation was conducted to determine if the testing performed on the 1-piece and the 2-piece round top rail will show equivalency for the use of the other respective top rails in accordance with the 2006 International Building Code, Section 1607.7.1.

2 Sample and Assembly Description

Intertek has tested the following 4 railing systems in full accordance with the load requirements of the 2006 IBC, Section 1607.7.1:

System 1 – 6 ft. Durarail 2-Piece Round Welded Picket Railing System

Post:	1.72 in. x 1.72 in. 6061-T6 extruded aluminum post
Base Plate:	2 in. x 2 in. x 5 in. x 1/4 in. 6061-T6 fascia mounted angle bars (2) each with 2 mounting holes
Top Rails:	42 in. high, 6063-T5 aluminum rail (2-piece round profile)
Picket Insert:	5/8 in. x 5/8 in. 6063-T5 aluminum spaced 4-1/2 in. o/c
Top Rail Connections:	2 piece with receiver channel, other connection details are provided in the Appendix

System 2 – 5 ft. Durarail 2-Piece Round Glass In-fill Railing System

Post:	1.72 in. x 1.72 in. 6061-T6 extruded aluminum post
Base Plate:	2 in. x 2 in. x 5 in. x 1/4 in. 6061-T6 fascia mounted angle bars (2) each with 2 mounting holes
Top Rails:	42 in. high, 6063-T5 aluminum rail (2-piece round profile)
Panel Insert:	6 mm, tempered glass panel measuring 54 in. wide x 38 in. high
Top Rail Connections:	2 piece with receiver channel, other connection details are provided in the Appendix

System 3 – 6 ft. Excell 1-Piece Round Welded Picket Railing System

Post:	1.72 in. x 1.72 in. 6061-T6 extruded aluminum post
Base Plate:	2 in. x 2 in. x 5 in. x 1/4 in. 6061-T6 fascia mounted angle bars (2) each with 2 mounting holes
Top Rails:	42 in. high, 6063-T5 aluminum rail (1-piece round profile)
Picket Insert:	5/8 in. x 5/8 in. 6063-T5 aluminum spaced 4-1/2 in. o/c
Top Rail Connections:	1 piece post mount bracket, other connection details are provided in the Appendix

System 4 – 5 ft. Excell 1-Piece Round Glass In-fill Railing System

Post:	1.72 in. x 1.72 in. 6061-T6 extruded aluminum post
Base Plate:	2 in. x 2 in. x 5 in. x 1/4 in. 6061-T6 fascia mounted angle bars (2) each with 2 mounting holes
Top Rails:	42 in. high, 6063-T5 aluminum rail (1-piece round profile)
Panel Insert:	6 mm, tempered glass panel measuring 54 in. wide x 38 in. high
Top Rail Connections:	1 piece post mount bracket, other connection details are provided in the Appendix

The following systems have been evaluated to determine if they are equivalent to the systems above and would meet the requirements of the 2006 IBC, Section 1607.7.1:

System 5 – 6 ft. Durarail 2-Piece Square Welded Picket Railing System

Post:	1.72 in. x 1.72 in. 6061-T6 extruded aluminum post with a 6 in. 6061-T6 post insert
Base Plate (deck):	2 in. x 2 in. x 5 in. x 1/4 in. 6061-T6 fascia mounted angle bars (2) each with 2 mounting holes
Top Rails:	42 in. high 6063-T5 aluminum rail (2-piece square profile)
Picket Insert:	5/8 in. x 5/8 in. 6063-T5 aluminum spaced 4-1/2 in. o/c
Top Rail Connections:	2 piece with receiver channel, other connection details are provided in the Appendix

System 6 – 5 ft. Durarail 2-Piece Square Glass In-fill Railing System

Post:	1.72 in. x 1.72 in. 6061-T6 aluminum rail
Base Plate (deck):	2 in. x 2 in. x 5 in. x 1/4 in. 6061-T6 fascia mounted angle bars (2) each with 2 mounting holes
Top Rails:	42 in. high 6063-T5 aluminum rail (2-piece square profile)
Panel Insert:	6 mm, tempered glass panel measuring 54 in. wide x 38 in. high
Top Rail Connections:	2 piece with receiver channel, other connection details are provided in the Appendix

System 7 – 6 ft. Excell 1-Piece Square Welded Picket Railing System

Post:	1.72 in. x 1.72 in. 6061-T6 extruded aluminum post with a 6 in. 6061-T6 post insert
Base Plate (deck):	2 in. x 2 in. x 5 in. x 1/4 in. 6061-T6 fascia mounted angle bars (2) each with 2 mounting holes
Top Rails:	42 in. high 6063-T5 aluminum rail (1-piece square profile)
Picket Insert:	5/8 in. x 5/8 in. 6063-T5 aluminum spaced 4-1/2 in. o/c
Top Rail Connections:	1 piece post mount bracket, other connection details are provided in the Appendix

System 8 – 5 ft. Excell 1-Piece Square Glass In-fill Railing System

Post:	1.72 in. x 1.72 in. 6061-T6 aluminum rail
Base Plate (deck):	2 in. x 2 in. x 5 in. x 1/4 in. 6061-T6 fascia mounted angle bars (2) each with 2 mounting holes
Top Rails:	42 in. high 6063-T5 aluminum rail (1-piece square profile)
Panel Insert:	6 mm, tempered glass panel measuring 54 in. wide x 38 in. high
Top Rail Connections:	1 piece post mount bracket, other connection details are provided in the Appendix

Installation details of all 8 railing systems have been provided in the Appendix, along with specifications on each part.

3 Reference Documents

- 2006 International Building Code (2006 IBC)
- Intertek Test Report 3174887COQ-002A
- Intertek Test Report 3174887COQ-002B
- System Drawings
 - Durarail Welded Picket System w/ 1.72" Posts
 - Durarail Glass System w/ 1.72" Posts
 - Excell Welded Picket System w/ 1.72" Posts
 - Excell Glass System w/ 1.72" Posts

4 Evaluation Method

Durail 2 piece systems:

Intertek Test Report 3174887COQ-002A for Systems 1 and 2 show that these systems meet the load requirements stated in Section 1607.7.1 of the 2006 IBC using a factor of safety of 2.5. A safety factor of 4 was applied on the in-fill test on the tempered glass panel in accordance with Section 2407.1.1 of the 2006 IBC. Based on the noted test results, the alternate systems mentioned in Section 2 of this report (System 5 and 6) were evaluated for compliance in accordance with Section 1607.7.1 of the 2006 IBC.

Systems 5 and 6 are identical to Systems 1 and 2 in terms of the components being utilized in the railing system and the installation of the product, however, there is one key difference. The top rail used in Systems 1 and 2 consists of a 2-piece round 6063-T5 aluminum rail as detailed in diagram VS-35977A, whereas Systems 5 and 6 use a 2-piece square 6063-T5 aluminum rail as detailed in VS-11725A (see Appendix). Comparing the moment of inertias (I_x , I_y) for both top rails as detailed in the noted drawings, the square top rail has greater I_x and I_y values than that of the round top rail. The maximum bending stress in the top rail is determined following the relationship noted in Equation 1 below.

$$\sigma = \frac{My}{I_n} \quad (\text{Equation 1})$$

Where σ = bending stress
 M = bending moment
 y = thickness / 2
 I_n = I_x or I_y

Between the round top rail and square top rail systems, for equivalent loads the bending stress experienced in the square top rail would be lower than that experienced by the round top rail. As the bending stress is the failure cause for the top rail, the lower stress experienced by the square rail for equivalent loads means Systems 1 and 2 tested in Intertek Test Report 3174887COQ-002B would meet the requirements of Section 1607.7.1 of the 2006 IBC using the 2-piece square top rail detailed in Appendix Drawing VS-11725A.

Excell 1 piece systems:

Intertek Test Report 3174887COQ-002B for Systems 5 and 6 show that these systems meet the load requirements stated in Section 1607.7.1 of the 2006 IBC using a factor of safety of 2.5. A safety factor of 4 was applied on the in-fill test on the tempered glass panel in accordance with Section 2407.1.1 of the 2006 IBC. Based on the noted test results, the alternate systems mentioned in Section 2 of this report (System 7 and 8) were evaluated for compliance in accordance with Section 1607.7.1 of the 2006 IBC.

Systems 7 and 8 are identical to Systems 3 and 4 in terms of the components being utilized in the railing system and the installation of the product, however, there is one key difference. The top rail used in Systems 3 and 4 consists of a 1-piece round 6063-T5 aluminum rail as detailed in diagrams VS-40396B (glass infill) and VS-40827 (picket infill), whereas Systems 7 and 8 use a 1-piece square 6063-T5 aluminum rail as detailed in diagrams VS-39217B (glass infill) and VS-38399 (picket infill) (see Appendix). Comparing the moment of inertias (I_x , I_y) for both top rails (glass infill and picket infill compared respectively) as detailed in the noted drawings, the square top rail has greater I_x and I_y values than that of the round top rail. The maximum bending stress in the top rail is determined following the relationship noted in Equation 1 below.

$$\sigma = \frac{My}{I_n} \quad (\text{Equation 1})$$

Where σ = bending stress
 M = bending moment
 y = thickness / 2
 I_n = I_x or I_y

Between the round top rail and square top rail systems, for equivalent loads the bending stress experienced in the square top rail would be lower than that experienced by the round top rail. As the bending stress is the failure cause for the top rail, the lower stress experienced by the square rail for equivalent loads means Systems 3 and 4 tested in Intertek Test Report 3174887COQ-002B would meet the requirements of Section 1607.7.1 of the 2006 IBC using the 1-piece square top rail detailed in Appendix Drawings VS-39217B (glass infill) and VS-38399 (picket infill).

5 Conclusion

Intertek Testing Services NA Ltd. has conducted an engineering evaluation for Excell Railing System Ltd., on the Excell Welded Picket & Glass Railing System and Durarail Welded Picket & Glass Railing System, to evaluate the interchangeability of 2 respective types of top rails. The evaluation was conducted to determine if the testing performed on the 1-piece and the 2-piece round top rail will show equivalency for the use of the other respective top rails in accordance with the 2006 International Building Code, Section 1607.7.1. The evaluation, as described in Section 4 of this report, shows that the following systems meet the load requirements of Section 1607.7.1 of the 2006 IBC:

- System 1 – 6 ft. Durarail 2-Piece Round Welded Picket Railing System
- System 2 – 5 ft. Durarail 2-Piece Round Glass In-fill Railing System
- System 3 – 6 ft. Excell 1-Piece Round Welded Picket Railing System
- System 4 – 5 ft. Excell 1-Piece Round Glass In-fill Railing System
- System 5 – 6 ft. Durarail 2-Piece Square Welded Picket Railing System
- System 6 – 5 ft. Durarail 2-Piece Square Glass In-fill Railing System
- System 7 – 6 ft. Excell 1-Piece Square Welded Picket Railing System
- System 8 – 5 ft. Excell 1-Piece Square Glass In-fill Railing System

INTERTEK TESTING SERVICES NA LTD.

Reported by: 
Adriaan van der Lely, EIT
Engineer, Building Products

Reviewed by: 
Kal Kooner, P.Eng
Manager, Engineering Services CDN

ATTACHMENTS: Drawings of Durarail & Excell Railing Systems



