

# LIV BUILDING PRODUCTS TEST REPORT

**SCOPE OF WORK**

LOAD TESTING OF INVISIRAIL™ LITE 10 CONNECTORS.

**REPORT NUMBER**

103507801TOR-003

**TEST DATE(S)**

06/19/18 & 07/09/18

**ISSUE DATE**

07/18/18

**RECORD RETENTION END DATE**

07/18/23

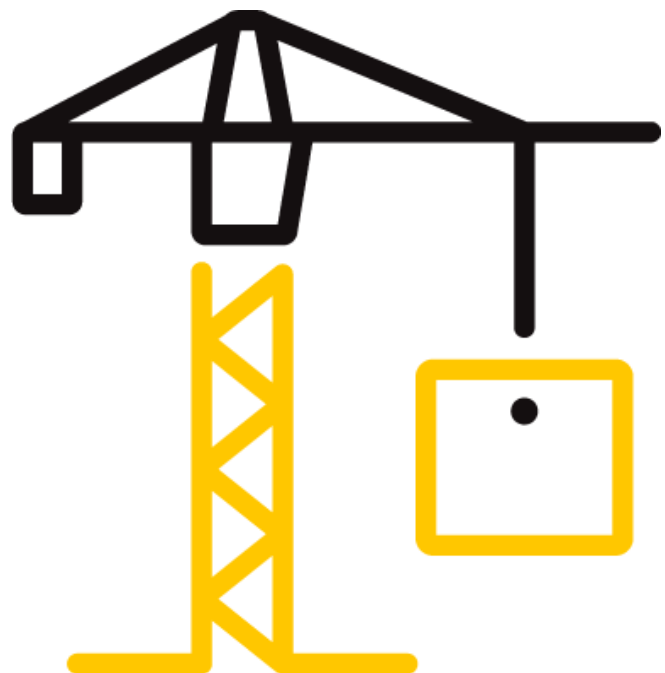
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## TEST REPORT FOR LIV BUILDING PRODUCTS

Report No.: 103507801TOR-003

Date: 07/18/18

### REPORT ISSUED TO

#### LIV BUILDING PRODUCTS

6050 Owen Road  
Uxbridge, ON L6P 1R1  
Canada

### SECTION 1

#### SCOPE

Intertek Building & Construction (B&C) was contracted by LIV Building Products, to perform load testing of Invisirail™ Lite 10 Connectors.


Testing was conducted at Intertek test facility in Mississauga, ON, on June 19<sup>th</sup>, 2018 and July 09<sup>th</sup>, 2018


### SECTION 2

#### SUMMARY OF TEST RESULTS

The Invisirail™ Lite 10 Connectors achieved the performance summarized in Section 7 of this report.

For INTERTEK B&C:

<b>COMPLETED BY:</b>	Tyrone Williams
<b>TITLE:</b>	Technician Building Products
<b>SIGNATURE:</b>	
<b>DATE:</b>	07/18/18

<b>REVIEWED BY:</b>	Joe DeRose, P. Eng.
<b>TITLE:</b>	Project Engineer, Evaluation Services
<b>SIGNATURE:</b>	
<b>DATE:</b>	07/18/18

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### SECTION 3

#### TEST METHOD(S)

The samples were evaluated following the principles of:

- **ASTM D935-13** "Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Building", Section 10 and 11.

### SECTION 4

#### EQUIPMENT

Calibration of test equipment was performed by Intertek B&C in accordance with ISO 17025 requirements.

**Table 1 - Equipment Calibration**

Instrument/Equipment	Asset #	Calibration Due Date
2K Load Cell with Digital Indicator	280-01-0774	Jan-15-2019
Stop Watch	273-01-1201	Apr-13-2019
600mm Scale	280-01-1234	Mar-26-2019
Tape Measure	280-01-1227	Aug-3-2018
Powerfist 24" stroke Hydraulic Ram	N/A	N/A
Electric Hydraulic Pump	N/A	N/A

### SECTION 5

#### TEST SAMPLE

##### 5.1 SAMPLE SELECTION

Representative samples were received and installed by the client and evaluated on June 19<sup>th</sup>, 2018 and July 09<sup>th</sup>, 2018. Testing was conducted at the Intertek facility located at 6225 Kenway Drive, Mississauga, Ontario.

##### 5.2 SAMPLE DESCRIPTION AND ASSEMBLY

**Invisirail™ Lite 10 Connectors fastened to ALX posts:** The test assembly consisted of two aluminium ALX posts measuring 63 mm x 63 mm x 1110 mm long having 4 mm thick walls and welded to a 127 mm x 127 mm x 10 mm aluminium base plate. The base plate had four (4)-12.65mm dia. holes spaced 95 mm on center and was anchored to concrete by 5/16 in. x 3 in. concrete screw anchors. The infill consisted of a single tempered glass lite measuring 1720 mm x 980 mm x 10 mm. The glass was supported by top and bottom Lite 10 Connectors which were secured to the post by three 3/16 in. x 1-1/4" in. self-drilling screws. Lite 10 Connectors are reported to be based on a nylon plastic. The posts were spaced 1807 mm on centres and the top of the glass was 1060 mm up from the floor surface.

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**Invisirail™ Lite 10 Connectors fastened to Vista posts:** The test assembly consisted of two aluminium Vista posts measuring 57.4 mm x 57.4 mm x 1100 mm long having 2.8 mm thick walls with four (4) screw ports. Posts were bolted to a 113.7 mm x 113.7 mm x 12 mm aluminium base plate using four(4) 5/16 in x 3 in bolts. The base plate had four (4)-10.5 mm dia. holes spaced 90 mm on center and was anchored to concrete by 5/16 in. x 3 in. concrete screw anchors. The infill consisted of a single tempered glass lite measuring 1720 mm x 980 mm x 10 mm. The glass was supported by top and bottom Lite 10 Connectors which were secured to the post by three 3/16 in. x 1-1/4" in. self-drilling screws. The posts were spaced 1807 mm on centres and the top of the glass was 1060 mm up from the floor surface.

**SECTION 6****TESTING AND EVALUATION****6.1 SAMPLE PREPARATION**

No sample preparation was required since the samples were tested as received.

**6.2 CONDITIONING**

Samples were tested in the laboratory under ambient conditions. No specific conditioning parameters were required before testing.

**6.3 PROCEDURE****6.3.1 Infill Load Test**

Test Loads were applied over a 100 mm x 100 mm square platen normal to the in-fill at the intersection of the horizontal and vertical center lines and vertical end (mid-span) of the in-fill. Specified and factored loads were applied and held for one (1) minute, whereupon deflection of the in-fill at the point of maximum deflection was recorded. After release of the load, residual deflection was recorded and the system was evaluated for failure, evidence of disengagement and visible cracks in any component.

**6.3.2 Uniform Load Test**

The top of the glass was subjected to horizontal quarter point loads applied by means of a load distributing steel bar. Specified and factored loads were applied and held for one (1) minute, whereupon deflection of the top rail at mid-span was recorded. After release of the load, residual deflection was recorded and the system was evaluated for failure, evidence of disengagement and visible cracks in any component.

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**6.3.3 Concentrated Load Test**

Concentrated test loads were applied separately and sequentially at the following three critical locations: *vertically on the top of the glass at mid-span between posts, horizontally on the top of the glass adjacent to a post, and horizontally on top of a single post*. Specified and factored loads were applied over a 100 mm x 100 mm square platen and held for one (1) minute, whereupon deflection was recorded at the point of application of the load. The load applied on the rail adjacent to the post was applied to the opposite post from which the top-of-post-test was performed on. After release of the load, residual deflection was recorded and the system was evaluated for failure, evidence of disengagement and visible cracks in any component.

**6.3.4 Applied loads**

The Applied Loads and Applied Factored Loads shown in Tables 2 and 3 were based on the specified loads in Table 9.8.8.2 of the 2015 National Building Code of Canada (NBC) and 2012 Ontario Building Code (OBC) increased by the following safety factors as applicable:

- Specified loads multiplied by  $1.5/\phi$ , where  $\phi=0.9$  resistance factor for “without any yielding”, resulting safety factor was 1.67.
- Specified loads multiplied by  $1.5/\phi$ , where  $\phi=0.75$  resistance factor for ductile failure mode, resulting safety factor was 2.0.
- Specified loads multiplied by  $1.67/\phi$ , where  $\phi=0.67$  resistance factor for brittle failure mode, the resulting safety factor was 2.5.

The Lite 10 Connectors are asymmetrical and were tested with the loads applied normal to the fixed face of the clamp. The loads were not applied normal to the removable sliding face. Please see appendix for picture of Lite 10 connectors.

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**SECTION 7**  
**TEST RESULTS**

Table 2 - Invisirail™ Lite 10 Connectors fastened to ALX post						
Load Type/Location	Applied Load	Deflection at Applied Load (mm)	Safety Factor	Factored Load	Applied Factored Load	Test Results
In-fill Load- center of glass	0.5 kN (112 lbf)	10	2.5	1.25kN (280 lbf)	1.25kN (280 lbf)	No evidence of disengagement or visible cracks was observed in any component of the test assembly
In-fill Load - Top of glass	0.5 kN (112 lbf)	17	2.5	1.25kN (280 lbf)	1.25kN (280 lbf)	
Horizontal Uniform Load- top end of glass (mid-span)	0.75 kN/m (52 lbf/ft)	35	2.5	1.88 kN/m (130 lbf/ft)	1.88 kN/m (130 lbf/ft)	No evidence of disengagement or visible cracks was observed in any component of the test assembly
Horizontal Concentrated Load- top end of glass (mid-span)	1.0 kN (224 lbf)	25	2.5	2.5 kN (560 lbf)	2.5 kN (560 lbf)	No evidence of disengagement or visible cracks was observed in any component of the test assembly
Horizontal Concentrated Load- Top of Post	1.0 kN (224 lbf)	10	2.0	2.0 kN (450 lbf)	2.0 kN (450 lbf)	No evidence of disengagement or visible cracks was observed in any component of the test assembly
Horizontal Concentrated Load- adjacent to post.	1.0 kN (224 lbf)	0.5 (clip deflection relative to post )	2.5	2.5 kN (560 lbf)	2.5 kN (560 lbf)	No evidence of disengagement or visible cracks was observed in any component of the test assembly at specified and factored load. A maximum load of <b>823 lbf</b> was attained when loaded to failure. The failure mode was fracture of the weld between the post and base plate.

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**Table 3 - Invisirail™ Lite 10 Connectors fastened to Vista post.**

Load Type/Location	Applied Load	Deflection at Applied Load (mm)	Safety Factor	Factored Load	Applied Factored Load	Test Results
<b>In-fill Load</b> - center of glass	0.5 kN (112 lbf)	11	2.5	1.25kN (280 lbf)	1.25kN (280 lbf)	No evidence of disengagement or visible cracks was observed in any component of the test assembly.
<b>In-fill Load</b> – vertical end of glass (mid-span)	0.5 kN (112 lbf)	5	2.5	1.25kN (280 lbf)	1.25kN (280 lbf)	
<b>Horizontal Uniform Load</b> - top end of glass (mid-span)	0.75 kN/m (52 lbf/ft)	22	2.5	1.88 kN/m (130 lbf/ft)	1.88 kN/m (130 lbf/ft)	No evidence of disengagement or visible cracks was observed in any component of the test assembly.
<b>Horizontal Concentrated Load</b> - top end of glass (mid-span)	1.0 kN (224 lbf)	27	2.5	2.5 kN (560 lbf)	2.5 kN (560 lbf)	No evidence of disengagement or visible cracks was observed in any component of the test assembly.
<b>Horizontal Concentrated Load</b> - Top of Post	1.0 kN (224 lbf)	24	2.0	2.0 kN (450 lbf)	2.0 kN (450 lbf)	No evidence of disengagement or visible cracks was observed in any component of the test assembly.
<b>Horizontal Concentrated Load</b> - adjacent to post.	1.0 kN (224 lbf)	0.5 <i>(clip deflection relative to post)</i>	2.5	2.5 kN (560 lbf)	2.5 kN (560 lbf)	No evidence of disengagement or visible cracks was observed in any component of the test assembly at specified and factored load. A maximum load of <b>1058 lbf</b> was attained when loaded to failure. The failure mode was yielding and bending of the post.

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### SECTION 8

#### CONCLUSION

Intertek Building & Construction (B&C) was contracted by LIV Building Products, to perform load testing of Invisirail™ Lite 10 Connectors.

The Invisirail™ Lite 10 Connectors as detailed in this report, achieved the performance summarized in Section 7.

The conclusions of this test report may not be used as part of the requirements for Intertek product certification. Authority to Mark must be issued for a product to become certified.



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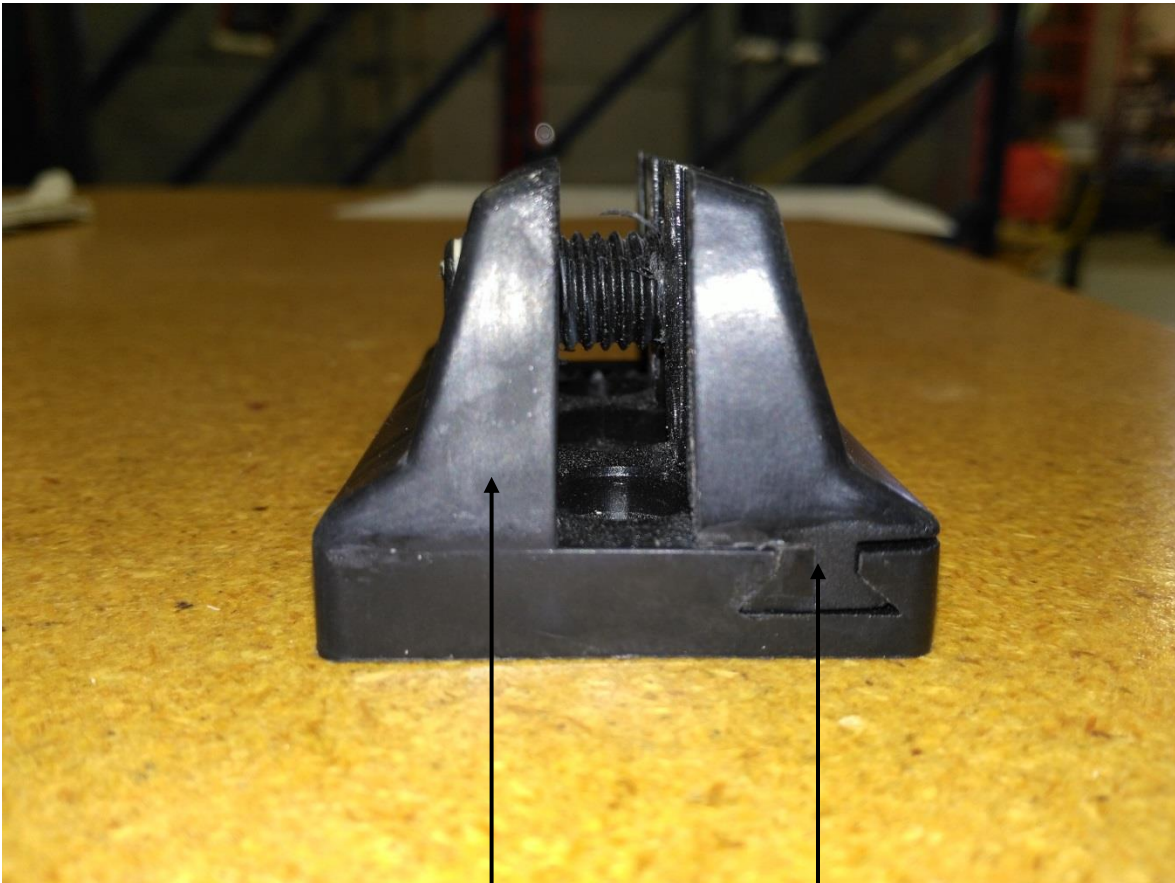
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### SECTION 9

### APPENDIX

#### Picture of "Lite 10 Connector"



**Fixed Face**

**Removable  
Sliding Face**



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6225 Kenway Dr.  
Mississauga, ON, L5T 2L3

Telephone: 905-678-7820  
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## TEST REPORT FOR LIV BUILDING PRODUCTS

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### SECTION 10

#### REVISION LOG

REVISION #	DATE	PAGES	REVISION
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