



**TEST REPORT**

Rendered to:

**LIV OUTDOOR INTERNATIONAL, INC.**

For:

**Nylon Railing Bracket**

**Report No: A6964.01-119-19**  
**Report Date: 05/31/11**



Architectural Testing

**TEST REPORT**

A6964.01-119-19

May 31, 2011

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Architectural Testing

## **TEST REPORT**

Rendered to:  
LIV OUTDOOR INTERNATIONAL, INC.  
6050 Owen Road  
Uxbridge, Ontario L9P 1R1  
Canada

Report No: A6964.01-119-19  
Test Date: 01/28/11  
Through: 05/05/11  
Report Date: 05/31/11

### **1.0 General Information**

#### **1.1 Product**

Nylon Railing Bracket

#### **1.2 Project Description**

Architectural Testing was contracted by Liv Outdoor International, Inc. to perform UV Resistance testing on their nylon material taken from railing brackets. The artificial weathering evaluation was conducted in accordance with Section 4.6, *Ultraviolet (UV) Resistance Test*, of ASTM D 7032-07, *Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails)*. ASTM D 7032-07 is referenced by the 2009 *International Residential Code*<sup>®</sup>, International Code Council. Testing also satisfies Section 3.7, *Ultraviolet (UV) Resistance*, of ICC-ES<sup>™</sup> AC174 (July 1, 2010), *Acceptance Criteria for Deck Board Span Ratings and Guardrail Systems (Guards and Handrails)*. AC174-09 was developed by the ICC Evaluation Service, Inc. (ICC-ES<sup>™</sup>) as acceptance criteria to evaluate compliance with the 2009 versions of *International Building Code*<sup>®</sup>, International Code Council and *International Residential Code*<sup>®</sup>, International Code Council.

#### **1.3 Limitations**

Testing reported herein is limited to satisfying the requirements of Section 4.6 of ASTM D 7032-07 as referenced by ICC-ES AC174.

#### **1.4 Qualifications**

Architectural Testing has demonstrated compliance with ANS/ISO/IEC Standard 17025 and is consequently accredited as a Testing Laboratory (TL-144) by International Accreditation Service, Inc. Architectural Testing is accredited to perform all testing reported herein.

## 1.5 Product Description

The nylon material (PA6) tested and reported herein was taken from the "Long Radius 3-Sided Connector" railing brackets. Test specimens consisted of five different colored products identified by the manufacturer as follows: Black, Cedar, Redwood, Pressure Treated (PT) Wood, and Mahogany. Drawings are included in Appendix A to verify the overall dimensions and other pertinent information of the tested product.

## 1.6 Product Sampling

All samples used for the testing reported herein were provided by Liv Outdoor International, Inc.

## 1.7 Witnessing

There were no witnesses from Liv Outdoor International, Inc. present for testing conducted and reported herein.

## 1.8 Conditions of Testing

Unless otherwise indicated, all testing reported herein was conducted in a laboratory set to maintain temperature in the range of  $68 \pm 4^{\circ}\text{F}$  and humidity in the range of  $50 \pm 5\% \text{ RH}$ . All test specimen materials were stored in the laboratory environment for no less than 40 hours prior to testing.

## 2.0 Reference Standards

*ASTM D 790-07, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials*

*ASTM D 2565-99 (Reapproved 2008), Practice for Operating Xenon-Arc-Type Light-Exposure Apparatus With and Without Water for Exposure of Plastics*

*ASTM D 7032-07, Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails)*

### **3.0 Ultraviolet (UV) Resistance**

Re: ICC-ES AC174 - Section 3.7

#### **3.1 General**

The purpose of the test is to evaluate the effect of weathering on the performance of the products. Material samples were taken from manufactured products and subjected to specified exposures of artificial weathering. Flexural tests were performed on the artificially weathered sample set and compared to identical tests performed on a set of control samples (non-weathered).

#### **3.2 Test Specimens**

Two sets of five test specimens were cut from separate production brackets and labeled as control (standard conditions) and artificially weathered samples. Test specimens were approximately 1/2 in wide by 4-1/2 in long by product thickness.

#### **3.3 Artificial Weathering Procedure**

Artificially weathered specimens were subjected to 2000 hours (01/28/11 through 04/26/11) of Xenon-Arc exposure in an Atlas Ci5000 Xenon Weather-Ometer<sup>®</sup> in accordance with ASTM D 2565 using Test Cycle 1. Exposure conditions were as follows:

Cycle: 102 minutes light only followed by 18 minutes of light with water spray  
Black Panel Temp:  $63 \pm 2^{\circ}\text{C}$   
Irradiance:  $0.35 \pm 0.02 \text{ W/m}^2$  at 340 nm

#### **3.4 Test Procedure**

Tests were performed using the methods described by Procedure A of ASTM D 790. Control specimens were conditioned for a minimum of 40 hours at laboratory ambient conditions. Artificially weathered specimens were conditioned at standard laboratory conditions for a minimum of 24 hours prior to flexural testing. All specimens were individually tested in a computer-monitored and -controlled SATEC Unidrive, Model MII 50 UD Universal Testing Machine using a three-point loading setup. The support span was set at 3.75 in with a loading nose located at midspan. Support and loading noses were 1/8 in radius steel rods. Deflections were continuously recorded during the loading process using the crosshead movement of the test machine. A loading rate of 0.100 in/min was used to control the test speed (crosshead movement). Artificially weathered samples were tested with the exposed, exterior surface down (in tension). See photographs in Appendix B for individual test setup.

### 3.5 Test Results

Stiffness properties were derived from a least square fit of load/deflection data between 10% and 40% of the maximum test load. Peak load and MOR were defined at ultimate bending strength. Reported peak loads were not limited by an outer surface strain of 0.05 in/in as referenced in Section 10.1.7 of ASTM D 790.

#### UV Resistance - Control Set (Non-Weathered)

Test Date: 05/05/11

Sample No.	Sample Color	Width (in)	Depth (in)	Peak Load (lb)	MOR (psi)	MOE (psi)
1	Mahogany	0.485	0.241	29.06	5803	156600
2	Black	0.489	0.239	35.94	7238	201300
3	Cedar	0.485	0.230	29.68	6508	181200
4	PT Wood	0.490	0.233	28.60	6048	167800
5	Redwood	0.490	0.240	29.69	5918	161000
<b>Minimum:</b>					5803	156600
<b>Maximum:</b>					7238	201300
<b>Average:</b>					6300	174000
<b>Standard Deviation:</b>					587	18072
<b>Coefficient of Variation:</b>					9%	10%

#### UV Resistance - Weathered

Test Date: 05/05/11

Sample No.	Sample Color	Width (in)	Depth (in)	Peak Load (lb)	MOR (psi)	MOE (psi)
1	Mahogany	0.485	0.238	37.17	7611	189800
2	Black	0.493	0.237	48.47	9846	260100
3	Cedar	0.492	0.235	33.83	7003	176000
4	PT Wood	0.487	0.229	39.57	8715	226500
5	Redwood	0.488	0.234	41.65	8768	218400
<b>Minimum:</b>					7003	176000
<b>Maximum:</b>					9846	260100
<b>Average:</b>					8400	214000
<b>Standard Deviation:</b>					1106	32903
<b>Coefficient of Variation:</b>					13%	15%

### 3.5 Test Results (Continued)

#### Match-Marked Sample Comparison Data Control Set vs. Artificially Weathered Set

Sample Number	Color	Control MOR (psi)	Artificially Weathered MOR (psi)	Difference MOR	Control MOE (psi)	Artificially Weathered MOE (psi)	Difference MOE
1	Mahogany	5803	7611	31.2%	156600	189800	21.2%
2	Black	7238	9846	36.0%	201300	260100	29.2%
3	Cedar	6508	7003	7.6%	181200	176000	-2.9%
4	PT Wood	6048	8715	44.1%	167800	226500	35.0%
5	Redwood	5918	8768	48.2%	161000	218400	35.7%
<b>Minimum:</b>		5803	7003	7.6%	156600	176000	-2.9%
<b>Maximum:</b>		7238	9846	48.2%	201300	260100	35.7%
<b>Mean:</b>		6300	8400	<b>33.4%</b>	174000	214000	<b>23.6%</b>

Section 4.6 of ASTM D 7032, as referenced by Section 3.7 of AC174, specifies a condition of acceptance of within a 10% loss in strength and within a 10% loss in stiffness properties after artificial weathering exposure. Therefore, no test load adjustment factors would be required due to artificial weathering of nylon components as tested and reported herein.

#### 4.0 Closing Statement

Detailed drawings, data sheets, representative samples of test specimens, a copy of this test report, and all other supporting evidence will be retained by Architectural Testing for a period of four years from the original test date. At the end of this retention period, said materials shall be discarded without notice, and the service life of this report by Architectural Testing shall expire. Results obtained are tested values and were secured using the designated test methods. This report neither constitutes certification of this product nor expresses an opinion or endorsement by this laboratory; it is the exclusive property of the client so named herein and relates only to the tested specimens. This report may not be reproduced, except in full, without the written approval of Architectural Testing.

For ARCHITECTURAL TESTING:

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John D. Miller III  
Project Engineer  
Structural Systems Testing

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Travis Hoover  
Program Manager  
Structural Systems Testing

JDM:jdm

Attachments (pages): This report is complete only when all attachments listed are included.

Appendix A - Drawings (3)

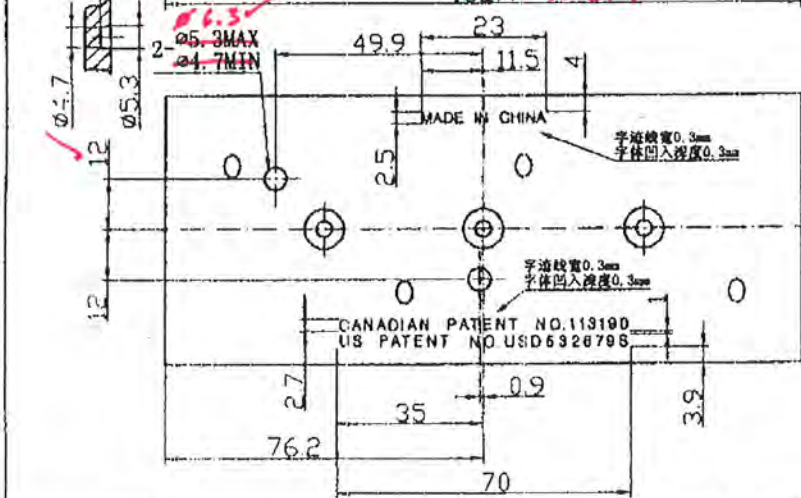
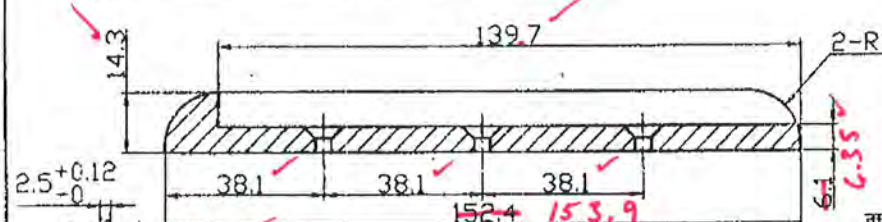
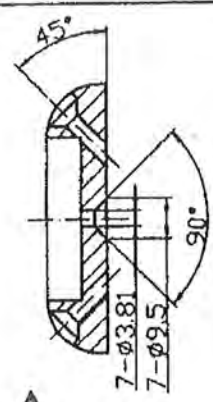
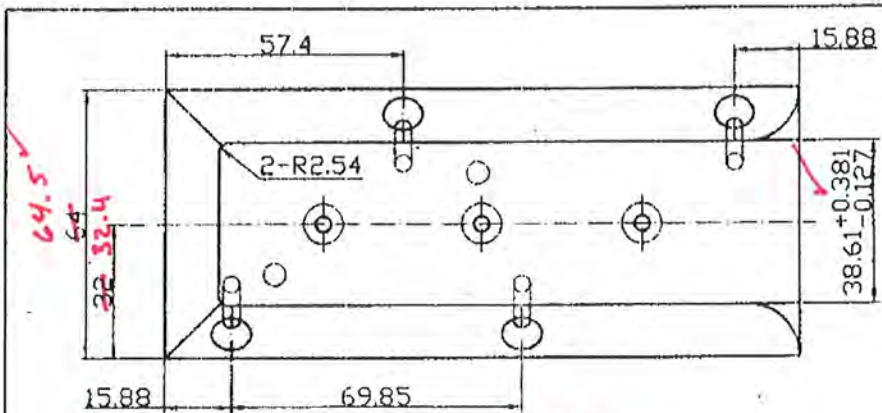
Appendix B - Photographs (3)

### Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	05/31/11	N/A	Original report issue

## **APPENDIX A**

### **Drawings**



**Architectural Testing**

Test sample complies with these details.  
Deviations are noted.

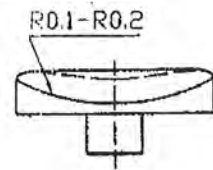
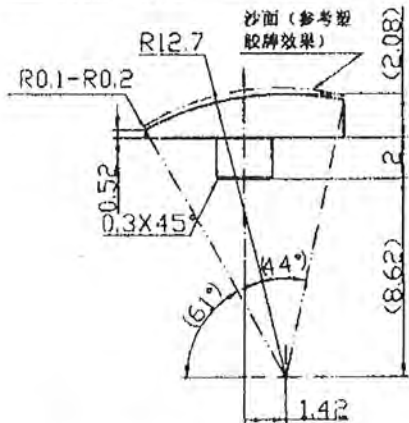
Report # **A6964.9-119-19**

Date **5-20-11** Tech **JDM**

**要求**

1. 材料：光亮防紫外线的尼龙 (NYLON)，材料能承受冬天零下30度低温及夏天40度高温下不会变型和断裂。
2. 每只胶牌配7PCS 银色不锈钢喇叭头φ5X50.8mm 螺丝。
3. 此件与任#LIV+6102346 (图号#6102346) 密吼垫牌配套使用。

产品名称：长型弧三边款胶牌

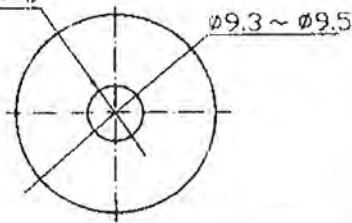


**要求**

1. 材料：含防紫外光成分的尼龙 (NYLON)。
2. 胶塞紧入螺丝头方吼后下沉塑胶牌弧形面0.1mm。
3. 图纸尺寸仅作参考，以实配为标准。
4. 每只胶牌配套4PCS。

产品名称：配套胶塞

(A) 不锈钢方批头螺丝方孔紧入) φ3



FLYING ROC INDUSTRIAL (H.K) LTD 飞鹏工业 (香港) 有限公司	
产品名称	长型弧三边款胶牌
TITLE	3H3-SIDED RADIUS COMING TOP
内部代号	LIV 草稿次数 1
DWG DATE 日期	2007年07月26日 July 26, 2007
DWG NO 图号	7071826 R

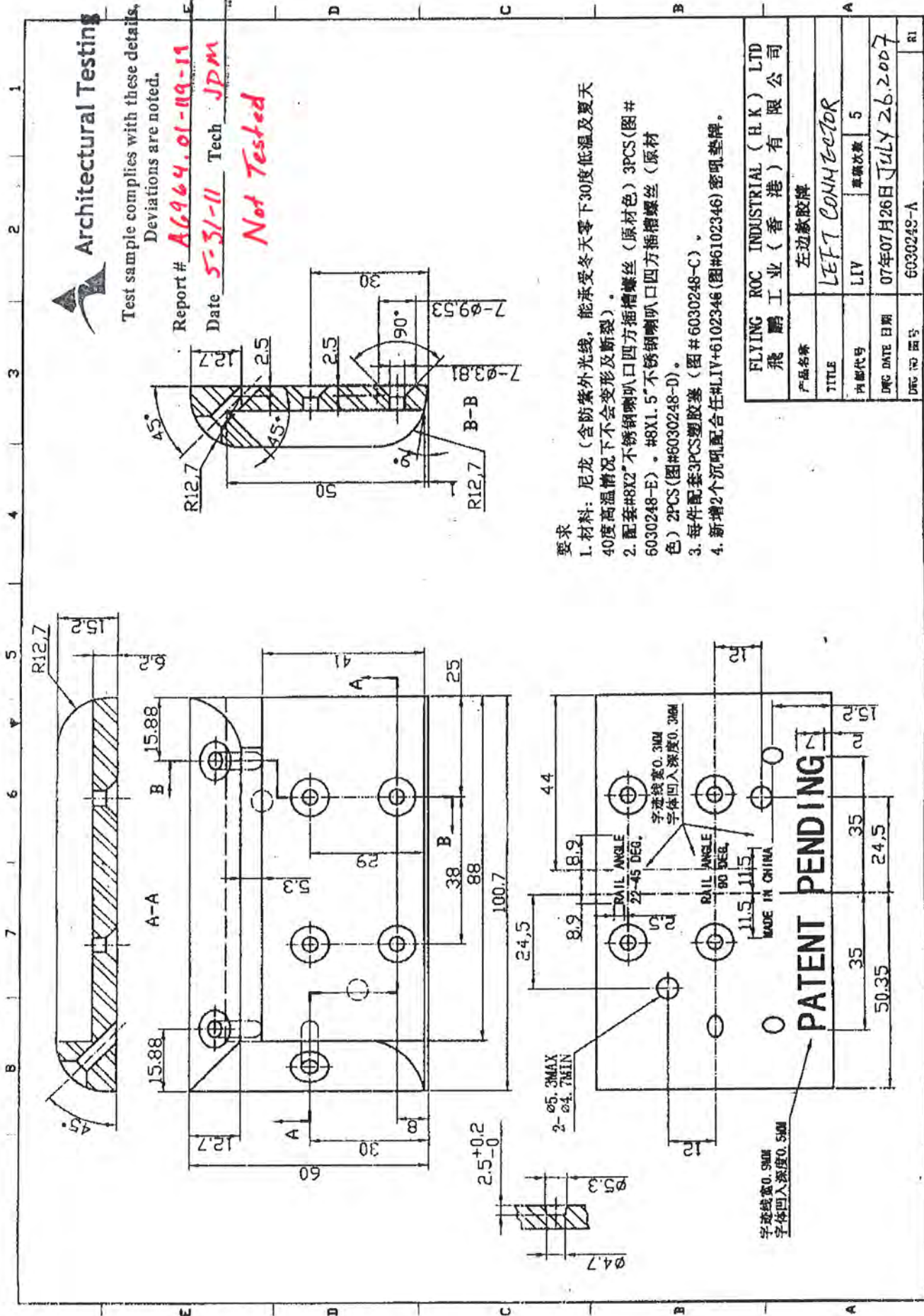
# Architectural Testing

Test sample complies with these details.  
Deviations are noted.

Report # **A6964.01-09-11**

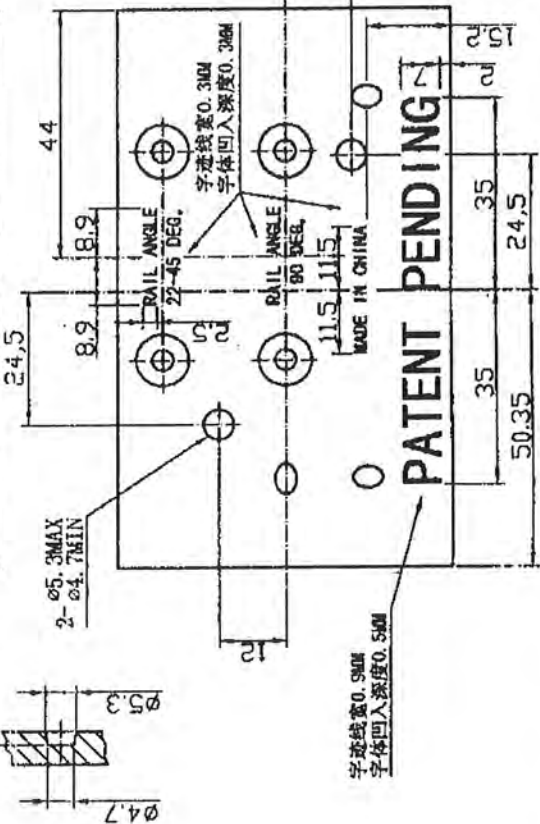
Date **5-31-11** Tech **JPM**

**Not Tested**



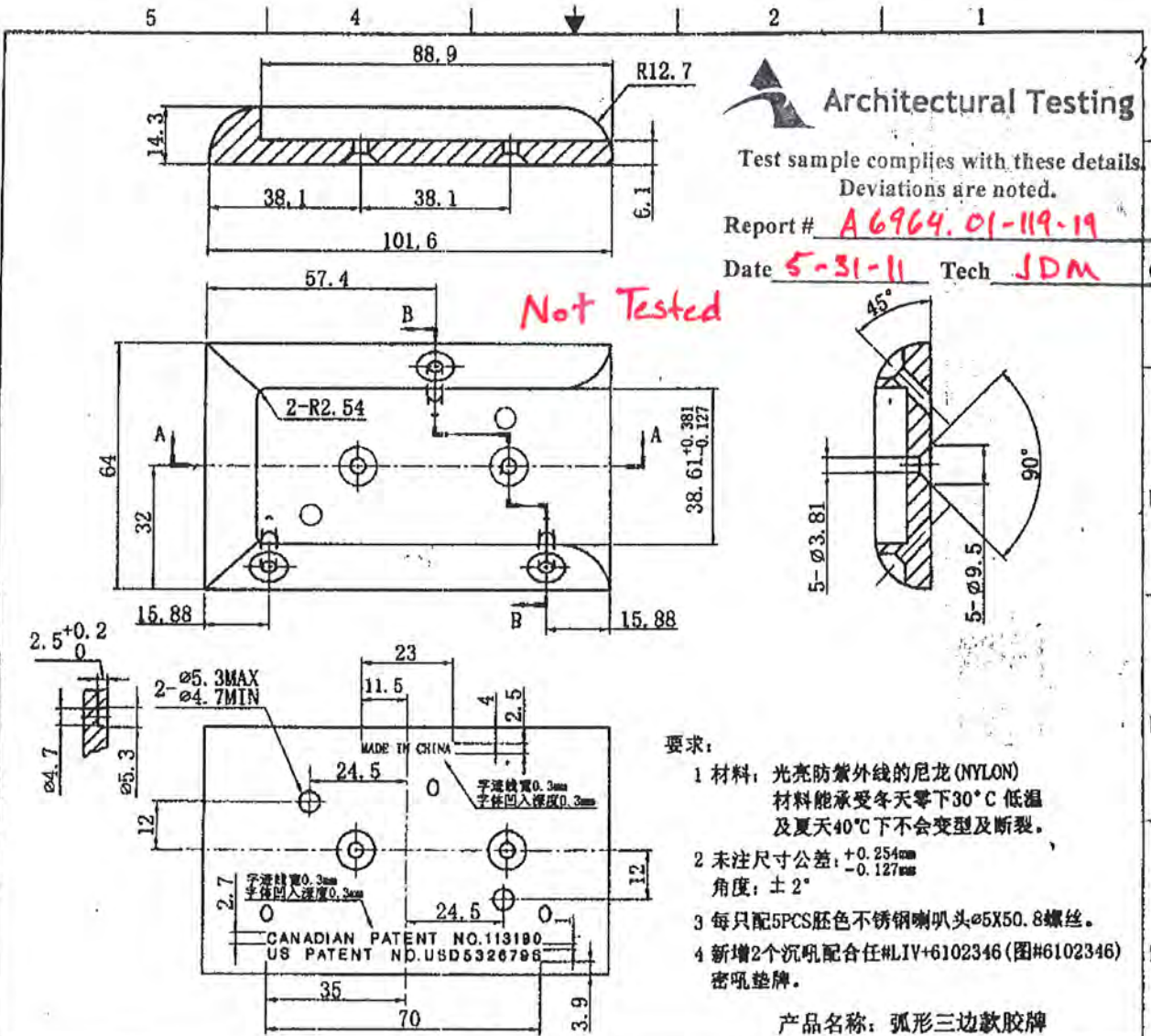
- 要求: 尼龙 (含防紫外线, 能承受零下30度低温及夏天40度高温情况下不会变形及断裂)。  
 1. 材料: 尼龙 (含防紫外线, 能承受零下30度低温及夏天40度高温情况下不会变形及断裂)。  
 2. 配套#8X2"不锈钢喇叭口四方插槽螺丝 (原材料色) 3PCS (图# 6030248-E)。#8X1.5"不锈钢喇叭口四方插槽螺丝 (原材料色) 2PCS (图#6030248-D)。  
 3. 每件配套3PCS密封胶塞 (图# 6030248-C)。  
 4. 新增2个顶吼配合任#LIV+6102346 (图#6102346) 密吼垫牌。

产品名称	FLYING ROC INDUSTRIAL (H.K.) LTD 飞鹏工业 (香港) 有限公司		
TITLE	左边款胶牌		
内部代号	LIV	草图次数	5
DATE 日期	07年07月26日	JULY 26.2007	
图号 图号	6030248-A		



字迹线宽0.5MM  
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PATENT PENDING



**Architectural Testing**

Test sample complies with these details.  
Deviations are noted.

Report # **A6964.01-119-19**

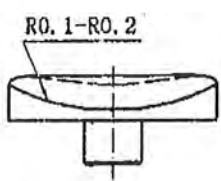
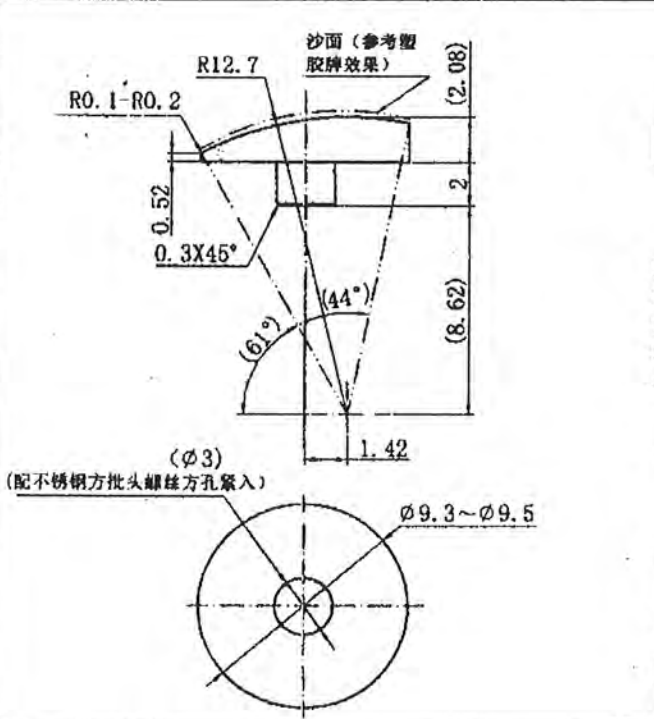
Date **5-31-11** Tech **JDM**

**Not Tested**

要求:

- 1 材料: 光亮防紫外线的尼龙 (NYLON)  
材料能承受冬天零下30°C 低温  
及夏天40°C下不会变形及断裂。
- 2 未注尺寸公差:  $+0.254mm$   
 $-0.127mm$   
角度:  $\pm 2^\circ$
- 3 每只配5PCS 银色不锈钢喇叭头  $\phi 5 \times 50.8$  螺丝。
- 4 新增2个沉孔配合任#LIV+6102346 (图#6102346)  
密吼垫牌。

产品名称: 弧形三边款胶牌



要求:

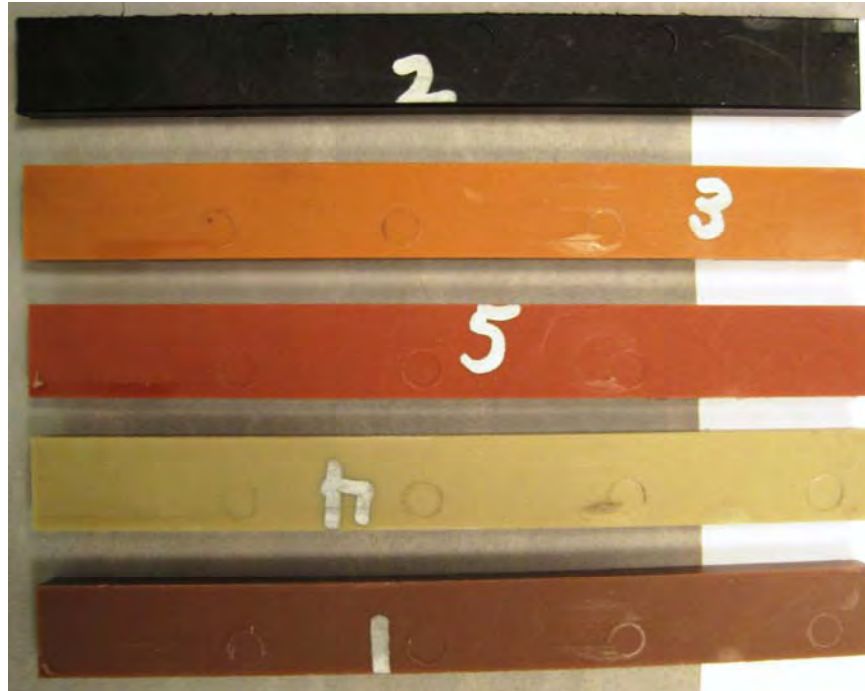
1. 材料: 含防紫外光成份的尼龙 (NYLON)。
2. 胶塞紧入螺丝头方孔后下沉型胶牌弧面0.1MM。
3. 图纸尺寸仅作参考, 以实配为标准。
4. 每只胶牌配套3PCS。

产品名称: 配套胶塞

FLYING ROC INDUSTRIAL (H.K) LTD			
飞鹏工业 (香港) 有限公司			
产品名称	弧形三边款胶牌		
TITLE	3-SIDED RADIUS CONNECTOR		
内帮代号	LIV	草稿次数	5
DWG DATE 日期	07年07月26日 July 26, 2007		
DWG NO 图号	31117-1918		R3

## **APPENDIX B**

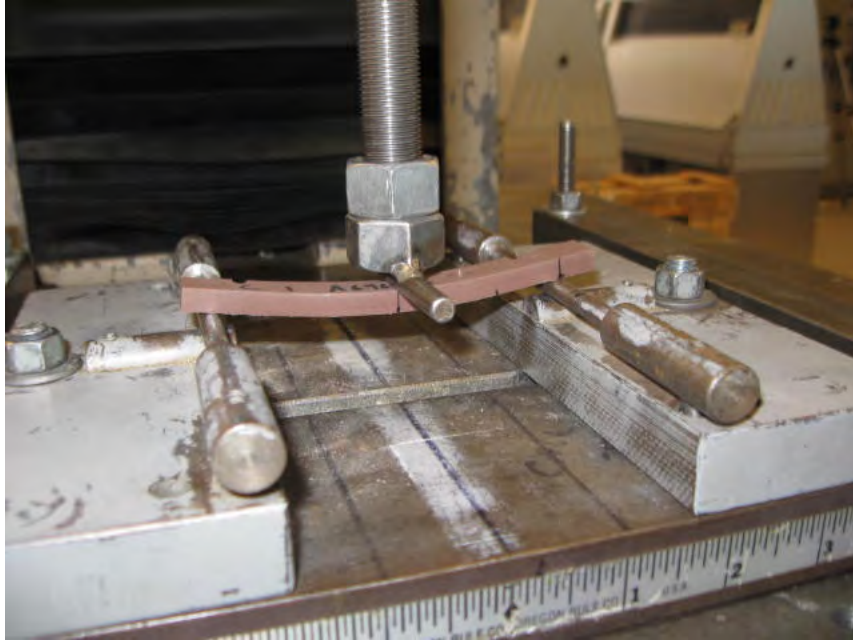
### **Photographs**



**Photo No. 1**  
**Specimen Colors (From Top to Bottom)**  
**Black, Cedar, Redwood, PT Wood, and Mahogany**



**Photo No. 2**  
**UV Resistance Testing - Specimens Installed in Artificial Weathering Machine**



**Photo No. 3**  
**UV Resistance Testing - ASTM D 790 Test Setup**