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**MODIFIED ASTM F0462, STANDARD CONSUMER SAFETY SPECIFICATION FOR
SLIP-RESISTANT BATHING FACILITIES:
TESTING 1/4-IN. MARINE PLYWOOD FACED TEAK WITH
DEEPSEAL FINISH™ BY BATH IN WOOD OF MAINE, LLC**

Prepared for:
Tawaraya LLC
P.O. Box 6041
Kamuela, HI 96743

Phone: 808-896-2479

Test Report: TARW062116-33
Issued: July 20, 2016

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Test Engineer

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INTRODUCTION

1.1. GENERAL

The Portable Articulated Strut Slip Tester (PAST) is a device for determining the slip resistance of footwear sole, heel, or related materials against planar surfaces in either the laboratory or field under specified conditions, in accordance with ASTM F0462¹. It must be noted that while this instrument is capable of measuring the static coefficient of friction of a surface, no result should be construed to indicate slippage is not possible.

1.2. OBJECTIVE AND SCOPE

Tawaraya retained NTA, Inc. to perform slip testing on piece of bathing facility flooring in accordance with ASTM F0462¹. Because of the nature of this test program, full compliance with F0462¹ cannot be determined. More specifically, it was not possible to assess compliance with all requirements under Section 5 of ASTM F462¹ since a full bathing facility was not tested.

2. TEST PROGRAM

2.1. DEVIATIONS FROM TEST STANDARD

Modifications to the requirements of the applicable test standards, as requested by the client, are detailed in Table 1 below.

Table 1: Test Method Deviations

Test / Standard	Standard Requirement	Deviation
ASTM F462	<ol style="list-style-type: none"> 1. A bathing facility (bathtub, shower or combination unit) is tested. 2. The bathing surface is visually examined to determine the compliance with the requirements of Section 5 of the standard. 3. Nine measurement areas are marked on bathing facilities to be tested by moving the tester along the walls of the bathing facility. 	<ol style="list-style-type: none"> 1. A partial bathing facility floor with a coating was tested. To facilitate testing the sample was placed in a container with the required depth of soapy water for testing. 2. Requirements regarding the assessment of the entire bathing surface could not be performed due to testing a partial floor sample. 3. Measurement areas were marked in an area that would allow for the entire test apparatus to sit on the test specimen for each measurement.

2.2. DESCRIPTION OF TEST SPECIMENS

The client provided (1) wood bathing facility floor sample, as described in Table 2, for testing. Photographs of the received specimen are provided in Figures 1 and 2.

It must be noted that NTA did not oversee or verify the sampling procedure used by the client when selecting the sample material(s). As necessary, NTA, Inc. provided commonly available materials needed for testing.

Table 2: Specimen

<p>A signed letter was provided by Stephen Batiste on behalf of Bath in Wood of Maine LLC with the sample stating the following: 1/4-in. Marine Plywood faced Teak sealed (on the tested surface) with DeepSeal Finish™ (See Figure 6) (Actual measured thickness 0.238-in.)</p>
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Table 3: Test Specifications

		Equipment/Materials
Test Apparatus	PAST	NIST-Brungraber Portable Slip-resistance Tester Serial Number 89 (NTA Asset #00190) PAST Constant, $k=0.93$
	Test Sensor	1.5-in. x 3.0-in. Medical Grade Silicone Rubber (NTA Asset # 00192)
	Reference Surface	1/4-in. thick plate glass in soap solution (NTA Asset #00216)
Soap Solution	Soap	Skilcraft Liquid Hand Soap Manufactured: 03/06/2013 Lot Number: C0139 Manufacturer Specification: P-S 624J
	Water	Steam Distilled
	Mixture	4:1 Water to Soap
	Solution Temperature	70 ±5°F

2.3 TESTING

2.3.1 PREPARATION FOR TESTING

The specimen was thoroughly cleaned with alcohol to remove any residue on the bathing surface. Next, the nine measurement zones were established; these zones were marked and numbered for reference. Figure 3 provides a picture of the specimen test surface with each test zone marked.. Next, the standard liquid soap solution, as specified in ASTM F0462¹, was introduced to cover all test areas with a depth not less than 1/2-in. and not more than 1-1/2-in (Figure 4).

2.3.2 TEST PROCEDURE

The test procedure was in accordance with ASTM F0462¹. Accordingly, the PAST was removed from its case and inspected for proper functioning. A trial run was performed using a PTFE sensor on a dry PTFE surface to verify the operation of the PAST. Once the operational check was complete, reference readings were taken on a reference surface consisting of 1/4-in. plate glass. A medical grade silicone elastomeric test sensor, in conformance with ASTM F0462¹, was used to take the reference readings and all readings throughout the evaluation. Six reference readings were taken in the same location on the reference surface at the beginning and end of the test program. The depth of the soap solution and the transverse and parallel inclination of the tester were recorded at the test location.

Once reference readings were obtained, the reference surface was removed and the PAST was positioned in measurement zone 1. In each zone, two PAST readings were taken and the transverse and parallel inclination and soap solution depth was recorded. A photograph from testing is provided in Figure 5. The PAST was then

repositioned and this procedure was repeated for all nine zones; resulting in a total of 18 readings for the measurement area.

3. TEST RESULTS

Results from testing are provided in Table 4, below. Additional data and information from testing is provided in the Appendix. Coefficient of friction values were calculated using Equation 1.

Table 4: Test Results

REFERENCE SURFACE TEST										
		Test Inclination		Reading (in.)						
	Solution Depth (in.)	Transverse	Parallel	#1	#2	#3	#4	#5	#6	Avg.
Pre-Test	9/16	-0.5°	-0.5°	0.5	0.45	0.4	0.45	0.45	0.45	0.45
Post-Test	9/16	-0.5°	-0.5°	0.5	0.55	0.5	0.65	0.5	0.55	0.54
BATHING SURFACE TEST										
		Test Inclination		Reading (in.)			Coefficient of Friction			
Test Zone	Solution Depth	Transverse	Parallel	#1	#2	Average				
1	3/4	-0.5	-0.5	2.95	2.90	2.93	0.23			
2	3/4	-0.5	-0.5	3.10	3.10	3.10	0.25			
3	3/4	-0.5	-0.5	3.10	3.15	3.13	0.25			
4	11/16	-0.5	-0.5	3.35	3.30	3.33	0.27			
5	3/4	-0.5	-0.5	2.85	2.85	2.85	0.23			
6	11/16	-0.5	-0.5	2.70	2.90	2.80	0.22			
7	3/4	-0.5	-0.5	2.45	2.65	2.55	0.20			
8	11/16	-0.5	-0.5	2.80	2.70	2.75	0.22			
9	3/4	-0.5	-0.5	2.45	2.50	2.48	0.19			

3.1. CALCULATIONS

PAST readings allow for comparison between surfaces tested using the same method. However, these readings can be converted to static coefficient of friction values using Equation 1 obtained from ASTM F1678². The static coefficient of friction is the ratio of the frictional force to the force acting perpendicular to the two surfaces in contact. This coefficient is a measure of the relative difficulty with which the surface of one material will slide over a surface adjoining itself, or of another material.

$$\mu_s = k \frac{(x - x_0)}{\sqrt{100 - (x - x_0)^2}} \tag{Equation 1}$$

where:

- k = instrument-specific constant furnished by the manufacturer
- x = tribometer average reading of test surface, see Table 2
- x₀ = the tribometer’s “zero point,” using the average pre and post-test reference surface measurement, see Table 2.

ASTM F0462¹ requires the lowest average static coefficient of friction in any of the nine measurement zone (average of the two readings) to be the basis for determining compliance. This value is reported in Table 4.

4. CONCLUSIONS

4.1. Tawaraya retained NTA, Inc. to perform slip testing on piece of bathing facility flooring in accordance with ASTM F0462¹. Conclusions from this testing are provided in Table 5, below. Because of the nature of this test program, full compliance with F0462¹ cannot be determined. More specifically, it was not possible to assess compliance with all requirements under Section 5 of ASTM F462¹ since a full bathing facility was not tested, as detailed in Table 6.

The results presented herein shall not be construed to mean that slippage is not possible on the test surface. Results are provided as-is and apply only to the tested specimen. Results may not be representative of typical production or generalized to a larger population.

Table 5: Conclusion Summary


Specimen	Lowest Average Coefficient of Friction (Unitless)	Required Level of Performance, Pass/Fail*
1/4-in. Marine Plywood faced Teak sealed (on the tested surface) with DeepSeal Finish™ by Bath in Wood of Maine LLC	2.48	0.19

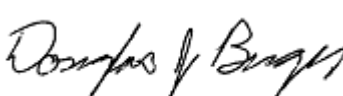
*In order to pass the lowest average static coefficient of friction must be 0.04 or greater

Table 6: Additional Criteria of ASTM F0462¹

Requirement	Complies
For Surfaces which have a textured or treated finish there shall be no area over which a 1-1/2-in. x 3-in. square may be laid and not touch any of the textured finish (visual examination).	N/A
Non-Integral material removable without damaging bathing surface (visual examination)	N/A
Bathing facility still within manufacturer's guarantee period.	N/A
Slip resistant surface must withstand marked deterioration (visual examination).	N/A
Measurement area shall be characteristic of entire bathing surface (visual examination).	N/A
Overall	N/A

Note: Per deviation #2 in Table 1 these requirements were not applicable (N/A) due to the type of specimen tested.

PREPARED BY:  _____ 07-20-2016
 Todd Ferguson
 Technician Date

REVIEWED BY:  _____ 07-20-2016
 Douglas Berger, P.E.
 Test Engineer Date

REFERENCES



1. American Society for Testing and Materials (ASTM). *Standard Consumer Safety Specification for Slip-Resistant Bathing Facilities*. ASTM F 0462-79 (Reapproved 2007). ASTM International, West Conshohocken, PA. 7 pp.
2. American Society for Testing and Materials (ASTM). *Standard Test Method for Using a Portable Articulated Strut Slip Tester (PAST)*. ASTM F 1678 - 96. ASTM International, West Conshohocken, PA, 1996. 3 pp.

FIGURES



Figure 1: Received (Coated Side that was Tested is Shown)



Figure 2: Received (Uncoated Side, Panel Backing)



Figure 3: (9) Measurement Zones Marked



Figure 4: Soap Solution Applied



Figure 5: Test In-Progress

FIGURES



07/14/2016 11:16AM FAX 2075264172

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0002/0002

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TEST SAMPLE

Brad Wear
NTA Inc.
305 NORTH OAKLAND AVENUE
NAPPANEE, INDIANA 46550

June 23, 2016

This notice certifies that the enclosed sample was produced by Bath in Wood of Maine LLC., in our workshops at the above address. It comprises 1/4" marine plywood faced in Teak, sealed in our trade marked process known as DeepSeal Finish™. This sample is wholly representative of the bottoms included in our bathtubs.

Stephen Batiste, Director
For and on behalf of Bath in Wood of Maine LLC.

Figure 6: Signed Letter

APPENDIX



TARW062116-33 ASTM F0462-79(2007) TEST (FINAL)
Summary Out Data

NTA, Inc.

SUMMARY DATA
ASTM F462-79 (Reapproved 2007)
Standard Consumer Safety Specification for Slip-Resistant Bathing Facilities

Test Location: N/A
N/A
N/A
N/A

Client: Tawaraya LLC
Job Number: TARW062116-33

General:
Date Received: 6/30/2016
Preparation Date: 7/8/2016
Prepared By: Tessa Parshall

Performed By: Tessa Parshall
Witnessed By: Bradley Wear

Product Description:

Specimen No.: 83782
Manufacturer: Bath in Wood of Maine, LLC.
Trade Name/Designation: DeepSeal Finish™
Lot/Batch #'s: Unknown
Model #: N/A
Serial #: N/A

Material Description: 1/2-in thick Marine Plywood faced with Teak and Sealed with textured DeepSeal Finish in a natural color as a representative sample of a bathtub bottom.

Years in Service: 0
Service Conditions: NEW
Any other Product Info: None
Nominal Size: 21.375-in. wide x 39.25-in. long x 0-in. deep
Product Type: Bathtub

Surface Retrofit: None
Applique / Non-Integral Material: None

Compliance Requirements	Complies
1 For Surfaces which have a textured or treated finish there shall be no area over which a 1-1/2-in. x 3-in. square may be laid and not touch any of the textured finish (visual examination).	N/A
2 Non-Integral / applique material removable without damaging bathing surface (visual examination)	N/A
3 Bathing facility still within manufacturer's guarantee period	N/A
4 Slip resistant surface must withstand marked deterioration (visual examination)	N/A
5 Measurement area shall be characteristic of entire bathing surface (visual examination).	YES

Overall Pass/Fail: **Pass**

This summary contains only data arrived at after employing the specific test procedures listed herein. This summary data might not include all reporting requirements of the test standard. The data herein does not constitute a recommendation for, endorsement of, or certification of the product or material tested. NTA, Inc. makes no warranty, expressed or implied, except that the test has been performed, and data prepared, based upon the specimen furnished by the client. Extrapolation of data, from the test data provided herein, to the batch or lot from which the specimens were obtained may not correlate and should be interpreted with extreme caution. NTA, Inc. assumes no responsibility for variations in quality, composition, appearance, performance, or other features of similar materials produced by the client, other persons, or under conditions over which NTA, Inc. has no control. NTA Inc. has issued this data summary for the exclusive use of the client to whom it is addressed. Any use or duplication of this summary shall not be made without their consent. This

APPENDIX



TARW062116-33 ASTM F0462-79(2007) TEST (FINAL)
Summary Out Data

NTA, Inc.

SUMMARY DATA
ASTM F462-79 (Reapproved 2007)
Standard Consumer Safety Specification for Slip-Resistant Bathing Facilities

Test Data:	Apparatus:	Asset No.
Test Date: 7/8/2016	P.A.S.T. (Portable Articulated Strut Slip Tester):	00190
Measurement Zone: 20-in. long x 15.75-in. wide	Test Sensor (Foot):	00192
Test Variable: <i>None</i>	Inclinometer:	00328
	Steel Rule:	00319
Soap Description: Liquid Hand Soap by Skilcraft by LHB Industries, Manufactured on 3/6/2013 under Lot No. C0139 to Specification Federal P-S 624J	Solution Thermometer:	01153
	Calibration Surface:	00216
Water-to-Soap Ratio: 4:1	Tape Measure:	01448
P.A.S.T. Calibration	Ambient Condition Sensor:	01155
Constant, k: 0.93		Specimen No.
P.A.S.T. Serial Number: 89		Soap: 62657
		Distilled Water: 83088
		Alcohol: 79999

Reference Surface Test Ambient Conditions:
Ambient Temp.: 71.6° F
Ambient R.H.: 53.9% R.H.

Reference Surface Tests

	Tester Inclination		Readings (in.)						Average
	Transverse	Parallel	#1	#2	#3	#4	#5	#6	
Pre-Test	-0.05	-0.05	0.5	0.45	0.4	0.45	0.45	0.45	0.45
Post-Test	-0.05	-0.05	0.5	0.55	0.5	0.65	0.5	0.55	0.541667
Overall Average									0.50

Pre-Test Ambient Conditions:
Ambient Temp.: 71.2° F
Ambient R.H.: 53.6% R.H.

Bathing Surface Tests

Meas. Zone	Tester Inclination		Readings (in.)			Average	Static Coefficient of Friction, μ_s (unitless)
	Transverse	Parallel	#1	#2	Average		
1	-0.5	-0.5	2.95	2.90	2.93	0.23	
2	-0.5	-0.5	3.10	3.10	3.10	0.25	
3	-0.5	-0.5	3.10	3.15	3.13	0.25	
4	-0.5	-0.5	3.35	3.30	3.33	0.27	
5	-0.5	-0.5	2.85	2.85	2.85	0.23	
6	-0.5	-0.5	2.70	2.90	2.80	0.22	
7	-0.5	-0.5	2.45	2.65	2.55	0.20	
8	-0.5	-0.5	2.80	2.70	2.75	0.22	
9	-0.5	-0.5	2.45	2.50	2.48	0.19	
Lowest Average						2.48	0.19
Required Level of Performance, Pass / Fail^a						PASS	

^a In order to pass the lowest average static coefficient of friction must be 0.04 or greater.

Post Test Ambient Conditions:
Ambient Temp.: 70.8° F
Ambient R.H.: 52.6% R.H.

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