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InteriorArts®

NEMA LD3-2005
Laminate Tests

Report from InteriorArts supplier,
Merino Industries.

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A Report to

MERINO Industries Inc.

from

North Carolina State University
Wood Products Laboratory

on

NEMA LD3-2005 Laminate Tests

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IMPORTANT

- These tests were conducted according to the procedures described in NEMA standards LD3-2005 except where noted.
- The NEMA LD3-2005 test procedures and standards were designed for high pressure decorative laminates, and their use with other products may produce misleading or irrelevant results.
- We do not certify a manufacturer's laminate. We report only on the results of a given sample of laminate which has been submitted to our laboratory.
- The name of the University is not to be used in any type of advertising or promotional efforts.
- We have undertaken high pressure decorative laminate testing as an independent testing laboratory largely as a service to the laminate manufacturers and the furniture industry. However, our main purpose is that of education and research, which means that we cannot always respond quickly to requests for testing.

Merino Industries Inc submitted one sample of a grey, solid color, 0.7mm thick standard grade HPDL for testing according to the test methods in NEMA LD3-2005. The following tests were requested:

LD3-2005
- 3.1 Appearance
- 3.3 Light Resistance
- 3.4 Cleanability/Stain Resistance
- 3.5 Boiling Water Resistance
- 3.6 High Temperature Resistance
- 3.8 Ball Impact Resistance
- 3.9 Dart Impact Resistance
- 3.10 Radiant Heat Resistance – coil method
- 3.10 Radiant Heat Resistance – strip method
- 3.11 Dimensional Change
- 3.12 Dimensional Stability
- 3.13 Wear Resistance
- 3.15 Blister Resistance

Results of the tests follow. A summary table of test results is appended.

TEST RESULTS

3.1 APPEARANCE

TEST RESULTS

3.1.4 Visual Inspection for type A, B, C defects

	type A defects	type B defects	type C defects
sample # **1**	0	0	0

3.1.5 Warpage – height of highest corner

	height of highest corner (**mm**)
sample # **1**	37

3.1.6 Broken Corners – number / distance to corner

	number	size (**mm**)
sample # **1**	0	

3.1.7 Squareness – difference in cross-corner lengths

	Squareness (**mm**)
sample # **1**	1

3.1.8 Edge Straightness – mm deviation per meter of edge

	Straightness (**mm/m**)
sample # **1**	< 0.5mm/m

3.3 LIGHT RESISTANCE

TEST CONDITIONS

black panel temp	70C
wet bulb depression	11C
conditioning water	20C
calibration at	420nm
irradiance rate	1.09 W/m2 (1.10 ± 0.03)
total irradiance	**285.1 kJ/m2**

TEST RESULTS

	Light Resistance =
sample # **1**	**NO EFFECT**

No Effect = no visible color or gloss change under the specified viewing conditions
Slight Effect = difficult to perceive change in color or gloss visible only at certain viewing angles or directions
Moderate effect = difficult to perceive change in color or gloss visible at all viewing angles or directions
Severe Effect = easily perceived change in color or gloss, or permanent change/damage to the decorative surface

3.4 CLEANABILITY/STAIN

TEST RESULTS

Sample #	Cleanability	Stain Resistance *(reagents not listed = no effect)*
sample # **1**	**11**	**moderate effect** – reagent 12 **no effect** – reagents 1-11,13-15

reagent #	stain reagent
1	Distilled water
2	50:50 SD-3A ethyl alcohol:water
3	Acetone
4	Household ammonia (non-sudsing)
5	10% Citric acid solution
6	Vegetable cooking oil
7	Freshly prepared coffee
8	Freshly prepared tea
9	Tomato catsup
10	Plain prepared yellow mustard
11	Povidone iodine (10%)
12	Permanent Marker Pen
13	#2 pencil
14	Wax crayon
15	Shoe polish (black paste)

Cleaning steps: *(see NEMA LD3 2000 for full descriptions)*

1.tap water -- removed = (0)
2.BCS + sponge w/1 kg weight -- 25 cycles -- rinse w/ tap water --removed = (1)
3.BCS + baking soda +brush -- 25 cycles -- rinse w/ tap water --removed = (2).
4.cotton ball + nail polish remover -- rub ≤ 2 minutes-- rinse w/ tap water --removed = (3)
5.cotton ball w/ bleach --2 minutes-- rinse w/ tap water --removed = (4).
6.if reagent remains visible = (5).

Cleanability = sum of reagent cleaning scores
Stain Resistance = No Effect / Moderate Effect / Severe Effect -- (reagents with cleaning score=5)
No Effect = no visible color or surface change under the specified viewing conditions
Moderate effect = difficult to perceive stain visible at all viewing angles or directions
Severe Effect = easily perceived stain, or permanent change/damage to the decorative surface

TEST DATA

		cleaning steps					cleanability score	stain
		0	1	2	3	4		
1	water						0	N
2	ethanol						0	N
3	acetone						0	N
4	ammonia						0	N
5	citric acid						0	N
6	veg. oil						0	N
7	coffee						0	N
8	tea						0	N
9	catsup						0	N
10	mustard						0	N
11	iodine						0	N
12	perm. marker	1	1	1	1	1	5	**M**
13	pencil	1	1				2	N
14	crayon	1	1				2	N
15	shoe polish	1	1				2	N
	Cleanability						**11**	

cleaning steps: (cleanability score)	0 =	removed with water
	1 =	20 cycles spray cleaner on sponge
	2 =	20 cycles baking soda +spray cleaner on brush
	3 =	nail polish remover
	4 =	bleach
	5 =	not removed -- describe stain as Moderate (M) or Severe (S)
Stain Resistance	N =	No Effect (=cleaning scores 0-4)
	M =	Moderate Effect -- difficult to perceive stain
	S =	Severe Effect -- easily preceived stain, or damaged surface
cleanabilit y =		NEMA LD3 cleanability score = sum cleaning score for reagents 1-15

3.5 BOILING WATER RESISTANCE

TEST RESULTS

	Boiling Water Resistance =
sample # **1**	**NO EFFECT**

No Effect = no visible color or gloss change under the specified viewing conditions
Slight Effect = difficult to perceive change in color or gloss visible only at certain viewing angles or directions
Moderate effect = difficult to perceive change in color or gloss visible at all viewing angles or directions
Severe Effect = easily perceived change in color or gloss, or permanent change/damage to the decorative surface

3.6 HIGH TEMPERATURE RESISTANCE

TEST RESULTS

	High Temperature Resistance =
sample # **1**	**NO EFFECT**

No Effect = no visible color or gloss change under the specified viewing conditions
Slight Effect = difficult to perceive change in color or gloss visible only at certain viewing angles or directions
Moderate effect = difficult to perceive change in color or gloss visible at all viewing angles or directions
Severe Effect = easily perceived change in color or gloss, or permanent change/damage to the decorative surface

3.8 BALL IMPACT RESISTANCE

TEST CONDITIONS

224g steel ball – 38.1mm diameter
report drop height with no surface fracture in 3 replicate drops (see LD3 for details)

TEST RESULTS

	Ball Impact Resistance (**mm**)
sample # **1**	**650**

3.9 DART IMPACT RESISTANCE

TEST CONDITIONS

25g dart – 5mm diameter spherical tip
report drop height with no surface fracture prior to a series of 3 consecutive fractures (see LD3 for details)

TEST RESULTS

	Dart Impact Resistance (**mm**)
sample # **1**	**500**

3.10 RADIANT HEAT RESISTANCE – COIL METHOD

average time in seconds to failure of 3 test runs

TEST RESULTS

	Average Radiant Heat Resistance **(seconds)**
sample # **1**	**141**

TEST DATA

Sample	*Rep1*	*Rep 2*	*Rep 3*
sample # **1**	*132*	*147*	*145*

3.10 RADIANT HEAT RESISTANCE – STRIP METHOD

average time in seconds to failure of 3 test runs

TEST RESULTS

	Average Radiant Heat Resistance **(seconds)**
sample # **1**	**142**

TEST DATA

Sample	*Rep1*	*Rep 2*	*Rep 3*
sample # **1**	*136*	*146*	*145*

3.11 DIMENSIONAL CHANGE

average of 3 replicates

TEST CONDITIONS

conditioned at 50% RH 70F
wet = 93%RH 40C for 7 days
dry = convection oven at 70C for 24hrs

TEST RESULTS

	Dimensional Change	
	Machine Direction	Cross Machine Direction
sample # **1**	**0.53%**	**0.88%**

3.12 ROOM TEMPERATURE DIMENSIONAL STABILITY

average of 3 replicate samples

TEST CONDITIONS

conditioned at 50% RH 70F
wet = 98%RH 70F for 4 days
dry = 10% RH at 70F for 4 days

TEST RESULTS

	Room Temperature Dimensional Stability	
	Machine Direction	Cross Machine Direction
sample # **1**	**0.34%**	**0.70%**

3.13 WEAR RESISTANCE

TEST CONDITIONS

abrasive strip correction factor = 1.078
wear resistance is the average of initial and final points for 3 samples, adjusted by the abrasive strip correction factor, and rounded to the nearest 50 cycles

TEST RESULTS

Average Corrected WEAR RESISTANCE *rounded to nearest 50 cycles*

	Average cycles
sample # **1**	**450**

TEST DATA

Sample	*Initial Point (raw cycles)*	*Final Point (raw cycles)*
replicate # **1**	*275*	*550*
replicate # **2**	*275*	*550*
replicate # **3**	*275*	*550*

3.15 BLISTER RESISTANCE

average time in seconds to failure of 3 test runs
postforming grades only

TEST RESULTS

	Average Blister Resistance **(seconds)**
sample # **1**	**54**

TEST DATA

Sample	*Rep1*	*Rep 2*	*Rep 3*
sample # **1**	*56*	*53*	*54*

TEST SUMMARY

NEMA LD3-2005 TEST			***Merino 0.7mm***	*NEMA LD3 VGS*
LD3.1	Appearance			
	3.1.4 Visual			
	Type A defects - smudges/smears/streaks/fingerprints	#A	**--**	*0*
	Type B defects - single particles 0.60mm2 or more	#B	**--**	*0*
	Type C defects - 3+,each 0.30mm2+,w/in 300mm d.circ	#C	**--**	*0*
	3.1.5 Thickness		**0.683**	*0.7 +/- 0.10*
	3.1.6 Flatness	max ht	**37**	*120*
	3.1.7 Broken Corners	#, dist. to corner	**0**	*1@25mm or 2@13mm*
	3.1.8 Squareness	dif. cross corner lens.	**1**	*6*
		cross corner lens.	**2760/2759**	
	3.1.9 Edge Straightness	mm dev./ m edge len	**<0.5mm**	*1.5*
LD3.3	Light Resistance -- xenon arc	NE | SL | M | S	**NE**	*SL*
LD3.4	Cleanability/Stain Resistance	cleanability sum of scores	**11**	*20*
	clean: sum of scores reagents 1-15 // stain: list all w/ M || S	1-10:NE | M | S	**NE**	*NE*
	water:0 | 25/bc.sponge:1 | 25/bk.sod.br:2 | solv:3 | ClO:4 | 5	11-15:NE | M | S	**12-M**	*M*
LD3.5	Boiling Water Resistance	NE | SL | M | S	**NE**	*NE*
LD3.6.3	High Temperature Resistance (oil)	NE | SL | M | S	**NE**	*SL*
LD3.8	Ball Impact	impact height (3rep)	**650**	*500*
LD3.9	Dart Impact Resistance	impact height (3con.brk)	**500**	*200*
LD3.10.2	Radiant Heat Resistance (coil)	ave. 3 samp. in sec	**141**	*80*
LD3.10.3	Radiant Heat Resistance (strip)	ave. 3 samp. in sec	**142**	
LD3.11	Dimensional Change	ave md %	**0.53%**	*0.70%*
		ave cmd %	**0.88%**	*1.20%*
LD3.12	Dimensional Stability	ave md %	**0.34%**	*0.60%*
		ave cmd %	**0.70%**	*1.10%*
LD3.13	Wear Resistance	ave.corr.WR rounded(50)	**450**	*400*
LD3.15	Blister Resistance	ave of 3 in sec	**54**	*--*