

HYUNDAI L&C CO., LTD TEST REPORT

SCOPE OF WORK

ANSI/NEMA LD3, FOR HIGH-PRESSURE DECORATIVE LAMINATES AND IAPMO/ANSI Z124.3,
AMERICAN NATIONAL STANDARD FOR PLASTIC LAVATORY UNITS EVALUATION OF SOLID
SURFACE - HANEX

REPORT NUMBER

K9471.02-106-31 R0

TEST DATES

04/29/20 - 09/11/20

ISSUE DATE

10/13/20

RECORD RETENTION END DATE

09/11/24

PAGES

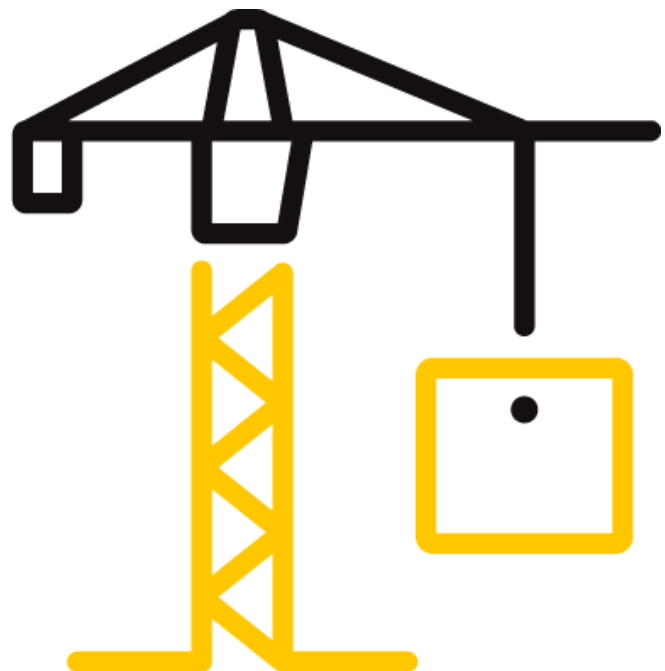
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Date: 10/13/20

REPORT ISSUED TO

HYUNDAI L&C CO., LTD

37, Buganggeumho-ro, Bugang-myeon

Sejong-si, 30074

South Korea

SECTION 1

SCOPE

Products: Solid Surface - Hanex

Intertek Building & Construction (B&C) was contracted by Hyundai L&C Co., Ltd to evaluate one Solid Surface - Hanex product in accordance with ANSI/NEMA LD 3 for High-Pressure Decorative Laminates and IAPMO/ANSI Z124.3 for Plastic Lavatories. Results obtained are tested values and were secured by using the designated test methods. Testing was conducted at the Intertek B&C test facility in York, Pennsylvania.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

For INTERTEK B&C:

COMPLETED BY:	Rodney E. Holland	REVIEWED BY:	Joseph M. Brickner
TITLE:	Technician III Materials Laboratory	TITLE:	Laboratory Supervisor Materials Laboratory
SIGNATURE:		SIGNATURE:	
DATE:	10/13/20	DATE:	10/13/20

REH:jmb/als

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SECTION 2

TEST METHODS

The specimens were evaluated in accordance with the following:

ANSI/NEMA LD 3-2005, *High-Pressure Decorative Laminates*

IAPMO/ANSI Z124.3-2005, *American National Standard for Plastic Lavatory Units*

SECTION 3

MATERIAL SOURCE

The materials were provided by Hyundai L&C Co., Ltd. The following were received on 4/23/20 in good condition:

- (1) NEMA LD Sec. 3.3 - Light Resistance
- (1) NEMA LD Sec. 3.5 - Boiling Water
- (1) NEMA LD Sec. 3.6 - High Temp. Resistance
- (2) NEMA LD Sec. 3.8 - Ball Impact Resistance
- (2) NEMA LD Sec. 3.10 - Radiant Heat Resistance
- (1) ANSI Z124.3 Sec. 4.3 - Point Impact Resistance
- (18) ANSI Z124.3 Sec. 5.2 - Stain Resistance Test
- (9) ANSI Z124.3 Sec. 5.3 - Wear and Cleanability Test
- (1) ANSI Z124.3 Sec. 5.4 - Cigarette Test
- (17) ANSI Z124.3 Sec. 5.5 - Chemical Resistance Test

Refer to the product description photos in Section 9. The material was tested as received. Representative materials/test specimens will be retained by Intertek B&C for a minimum of four years from the test completion date.

SECTION 4

LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Rodney E. Holland	Intertek B&C
Joseph M. Brickner	Intertek B&C

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SECTION 5

TEST PROCEDURES

All conditioning of test specimens and test conditions were at standard laboratory conditions unless otherwise reported. Refer to the test related photos in Section 9. Calibration certificates available upon request.

NEMA LD (Sec. 3.3) - Light Resistance

Three specimens, nominally 6 in. x 1 in. x 0.5 in. thick, were used for testing. The specimens were mounted in a Ci5000 Weatherometer (ICN: 005154). One-half of each specimen was exposed to a light source at a rate of irradiance of $1.10 \pm 0.03 \text{ W/m}^2 @ 420\text{nm}$ for a period of 72 ± 2 hrs. The lamp was fitted with a Soda Lime outer filter and a Borosilicate Inner filter to produce a simulate the range of sunlight through window glass. At the conclusion of the exposure period, the specimens were removed from the weatherometer and conditioned at room temperature for 24 hrs. The specimens were placed on a table and examined from a distance of approximately 30 to 36 in. at an angle of 45° to 75° from a horizontal plane, being viewed from all directions to see if a difference occurred between the exposed and unexposed areas of the test specimens. The light resistance rating was reported.

NEMA LD (Sec. 3.5) - Boiling Water

One, nominally 8 in. x 8 in. x 0.500 in. thick, specimen was used for testing. A heating vessel with a flat bottom, measuring 76 mm high x 90 mm diameter, was filled with water to 1/2 in. from the rim and heated on a hot plate (ICN: INT004169) until boiling. Ten (10) ml of the boiling water was then poured onto the horizontal surface of the test specimen, and the vessel with remaining boiling water was placed in the puddle of water on the test specimen and remained in place for 20 min. The vessel was removed, and the specimen was wiped clean to remove any residual contaminants. The specimen was allowed to stabilize at room temperature for 24 hrs. At the conclusion of 24 hrs., the specimen was viewed from a distance of approximately 30 to 36 in. at a 45° to 75° angle from the horizontal plane in all directions. Observations were recorded.

NEMA LD (Sec. 3.6) - High Temp. Resistance - Hot Wax Method

One, nominally 8 in. x 8 in. x 0.500 in. thick, specimen was used for testing. A heating vessel with a flat bottom, measuring 76 mm high x 90 mm diameter, was filled to 2/3 in. full of Paraffin Wax and heated on a hot plate (ICN: INT004169) until it reached a temperature of 365°F . The wax was allowed to cool to 356°F , and the vessel was placed on the test specimen and remained in place for 20 min. The vessel was removed from the specimen and was allowed to stabilize at room temperature for 24 hrs. At the conclusion of 24 hrs., the specimen was viewed from a distance of approximately 30 to 36 in. at a 45° to 75° angle from the horizontal plane in all directions. Observations were recorded.

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NEMA LD (Sec. 3.8) - Ball Impact Resistance

One, nominally 12 in. x 12 in. x 0.500 in. thick, specimen was used for testing. Using a ball impact apparatus (ICN: INT00600), an arbitrary height was used to determine the starting drop height for reportable testing. A polished stainless-steel ball, weighing 224 g and measuring 38.1 mm in diameter, was used for the impact testing. If the first drop did not produce a crack, the height was raised incrementally until a maximum height was reached where no cracking was observed. At the maximum height where no cracking was observed, two more drops were made to confirm that there was no cracking, and results were reported.

NEMA LD (Sec. 3.10) - Radiant Heat Resistance

Three, nominally 2 in. x 8 in. x 0.500 in. thick specimens were used for testing. One specimen at a time was placed in a heating apparatus, a stopwatch used in testing was started and the specimen was heated to 165°C. When initial damage was observed, the stopwatch was stopped, and the time of failure and the type of failure was recorded.

ANSI Z124.3 (Sec. 4.3) - Point Impact Loads

One, nominally 8 in. x 6 in. x 0.500 in. thick, specimen was used for testing. Using a ball impact apparatus (ICN: INT00600). A polished stainless-steel ball, weighing 224 g and measuring 38.1 mm in diameter, was dropped at a height of 20 in., on three different locations on the specimen. The specimen was evaluated for chips and cracks, and the results were reported.

ANSI Z124.3 (Sec. 5.2) - Stain Resistance Test

Seven, nominally 6 in. x 3 in. x 0.500 in. thick, specimens were used for testing. Seven reagents were used in the stain resistance tests. Two drops of each of the liquid reagent were applied to the seven test specimens. One test was conducted with each reagent uncovered and the other with each reagent covered with a watch glass to prevent evaporation. The reagents remained on the specimens for sixteen hours at room temperature. At the end of sixteen hours, the excess reagent was removed with a paper towel and evaluated. Each stain, both covered and uncovered, was given a number in accordance with the rating procedure given in section 5.2.1.1 through 5.2.1.5 of the test standards.

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ANSI Z124.3 (Sec. 5.3) - Wear and Cleanability Test

Three, nominally 4 in. x 4 in. x 0.500 in., test specimens were placed side by side on the Gardner Abrasion Tester, AG-8100 (ICN: Y000189). An abrasive slurry was made consisting of 3,000 mL of tap water, 15 grams of sodium carboxy-methyl cellulose, 60 grams of trisodiumphosphate, and 2,700 grams of US Silica SIL-CO-SIL 90. The abrasive slurry was run through a mini-pump. The rate of the slurry was established at 3 to 3.5 mL per minute, then testing was started. The AG-8100 abrasion tester was run at 37 cycles/min. A brush with fifty-nine bristles, weighing 446.4 grams and 653.6 grams of added weight for a total of 1,100 grams, scrubbed the test specimens for 10,000 cycles. The test was run in 2,500 cycle increments with excess slurry removed at each run prior to continued cycling. Once the 10,000 cycles was completed, the specimens were rinsed with tap water, dried, and measured for cleanability. Each specimen was measured for the white-light reflectance, using a GretagMacbeth Color i5 Spectrophotometer (ICN: 004725) with a diffuse spherical geometry and a xenon lamp, CIELAB color space, D65 illuminant, and 10° observer. An average of three readings, a 1/2 in. apart, were taken. Ten (10) grams of standard dirt was placed on each test specimen. With a damp cloth, thumb pressure was applied in circular motion for 25 cycles. The dirt was allowed to dry for 1 hr. The dirt was washed off the specimens with a clean, damp cloth and standard liquid detergent for 50 cycles, rinsed with water, and allow to dry. A second reading was taken, and the percentage of white-light reflectance was recorded.

ANSI Z124.3 (Sec. 5.4) - Cigarette Test

One, nominally 8 in. x 6 in. x 0.500 in. thick, specimen was used for testing. Three brands of cigarettes (Marlboro Gold, Marlboro Red, and Newport), were lit and placed 1 in. from the edge of the test specimen. The cigarettes were allowed to burn for two minutes. After two minutes, the cigarettes were removed, and the burned areas were allowed to cool. The burned areas were sanded with 400 grit sandpaper until the burn area was removed. The cigarette burn areas were observed for ignition and progressive glow of the specimen surface.

ANSI Z124.3 (Sec. 5.5) - Chemical Resistance Test

Twelve, nominally 6 in. x 3 in. x 0.500 in. thick, specimens were used for testing. Twelve chemicals were used in the chemical resistance tests. Two drops of each of the liquid chemical were applied to the twelve test specimens. One test was conducted with each chemical uncovered and the other with each chemical covered with a watch glass to prevent evaporation. The chemicals remained on the specimens for sixteen hours at room temperature. At the end of sixteen hours, the excess chemicals were removed with a paper towel. The twelve specimens remained at room temperature for an additional 24 hrs.

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SECTION 6

TEST SPECIMEN DESCRIPTIONS

TEST PROCEDURE	NUMBER OF SPECIMENS	NOMINAL SPECIMEN DIMENSIONS	VISUAL CHARACTERISTICS
NEMA LD Sec. 3.3	3	6 in. x 3 in. x 0.500 in.	Solid Surface - Hanex (White)
NEMA LD Sec. 3.5	1	8 in. x 8 in. x 0.500 in.	
NEMA LD Sec. 3.6	1	8 in. x 8 in. x 0.500 in.	
NEMA LD Sec. 3.8	1	12 in. x 12 in. x 0.500 in.	
NEMA LD Sec. 3.10	1	2 in. x 8 in. x 0.500 in.	
ANSI Z124.3 Sec. 4.3	1	8 in. x 6 in. x 0.500 in.	
ANSI Z124.3 Sec. 5.2	7	6 in. x 3 in. x 0.500 in.	
ANSI Z124.3 Sec. 5.3	9	4 in. x 4 in. x 0.500 in.	
ANSI Z124.3 Sec. 5.4	1	8 in. x 6 in. x 0.500 in.	
ANSI Z124.3 Sec. 5.5	12	6 in. x 3 in. x 0.500 in.	

SECTION 7

TEST RESULTS

NEMA LD (Sec. 3.3) - Light Resistance

SPECIMEN NO.	OBSERVATIONS AFTER 72 HOURS OF XENON ARC WEATHERING
1	a. No effect - no change in color or surface
2	a. No effect - no change in color or surface
3	a. No effect - no change in color or surface

NEMA LD (Sec. 3.5) - Boiling Water

SPECIMEN NO.	OBSERVATION
1	No effect - no change in color or surface

NEMA LD (Sec. 3.6) - High Temperature Resistance - Hot Wax Method

SPECIMEN NO.	OBSERVATION
1	Moderate effect - a change in color or surface finish visible from all angles and directions

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NEMA LD (Sec. 3.8) - Ball Impact Resistance

SPECIMEN NO.	MAXIMUM HEIGHT (mm)	OBSERVATION
1	2,514	No Fractures on 3 Impacts

NEMA LD (Sec. 3.10) - Radiant Heat Resistance

SPECIMEN NO.	TIME OF FAILURE (min:sec)	OBSERVATION
1	8:03	Deformation noticed, by the bowing of the specimen
2	8:03	Deformation noticed, by the bowing of the specimen
3	7:06	Deformation noticed, by the bowing of the specimen

ANSI Z124.3 (Sec. 4.3) - Point Impact Loads

SPECIMEN NO.	OBSERVATION
1	No cracks or chips - Pass

ANSI Z124.3 (Sec. 5.2) - Stain Resistance Test

REAGENT	RATING	OBSERVATION
Black crayon	1	No Staining
Black liquid shoe polish	3	Removed by 1st Application, Scouring Powder
Blue washable ink	1	No Staining
Gentian Violet solution	5	Stain Remaining
Iodine solution (1% alcohol solution)	2	Removed by Alcohol
Lipstick (contrasting color)	2	Removed by Alcohol
Hair dye (contrasting color)	4	Removed by 2nd Application, Scouring powder
Total Stain Rating	18	Pass

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ANSI Z124.3 (Sec. 5.3) - Wear and Cleanability Test

SPECIMEN NO.	CONDITION	WHITE LIGHT REFLECTANCE (L*)	CHANGE (%)
1	Initial	98.22	--
	Post Detergent Cleaning	96.37	-1.85 - Pass
2	Initial	96.38	--
	Post Detergent Cleaning	96.31	-0.07 - Pass
3	Initial	96.45	--
	Post Detergent Cleaning	96.31	-0.14 - Pass

ANSI Z124.3 (Sec. 5.4) - Cigarette Test

SPECIMEN NO.	CIGARETTE	OBSERVATION
1	Marlboro Gold	No ignition or progressive glow of the surface - Pass
2	Marlboro Red	No ignition or progressive glow of the surface - Pass
3	Newport	No ignition or progressive glow of the surface - Pass

ANSI Z124.3 (Sec. 5.5) - Chemical Resistance Test

CHEMICAL	OBSERVATION
Naphtha	The surface finish was unaffected by the reagent - Pass
Ethyl alcohol	The surface finish was unaffected by the reagent - Pass
Amyl acetate	The surface finish was unaffected by the reagent - Pass
1 part commercial household ammonia solution, 9 parts water by volume	The surface finish was unaffected by the reagent - Pass
Citric acid, 10% water solution	The surface finish was unaffected by the reagent - Pass
Urea, 6.0% water solution	The surface finish was unaffected by the reagent - Pass
Hydrogen peroxide, 3% water solution	The surface finish was unaffected by the reagent - Pass
Concentrated sodium hypochlorite solution ²⁰	The surface finish was unaffected by the reagent - Pass
Toluene	The surface finish was unaffected by the reagent - Pass
Ethyl acetate	The surface finish was unaffected by the reagent - Pass
Lye, 1% to 2% water solution ²¹	The surface finish was unaffected by the reagent - Pass
Acetone	The surface finish was unaffected by the reagent - Pass



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SECTION 8

CONCLUSION

The submitted materials were evaluated per sections of ANSI/NEMA LD 3 which does not contain specific performance criteria. Results are reported as found.

The submitted materials were also evaluated per sections of IAPMO/ANSI Z124.3 which contains specific performance criteria. The materials met the performance requirements for all tests that were performed.

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SECTION 9 PHOTOGRAPHS



Photo No. 1
Materials - As Received



Photo No. 2
NEMA LD 3.5 Boiling Water Resistance

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Photo No. 3
NEMA LD 3.5 Boiling Water Resistance
Specimen with Heating Vessel Placed on 10 ml of Water



Photo No. 4
NEMA LD 3.6 High Temperature Resistance
Evaluation of the Hot Wax Method - Test Result

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Photo No. 5

NEMA LD Sec. 3.8 Ball Impact Resistance - Test Setup

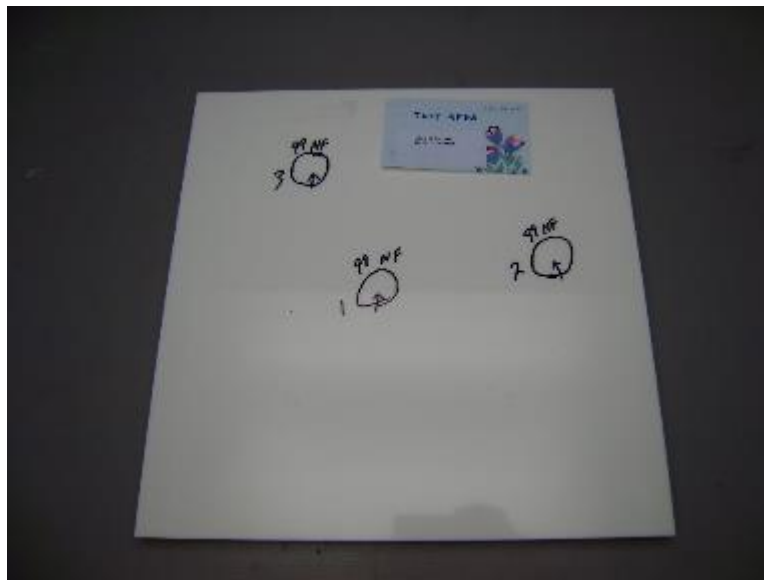


Photo No. 6

NEMA LD Sec. 3.8 Ball Impact Resistance - Test Result

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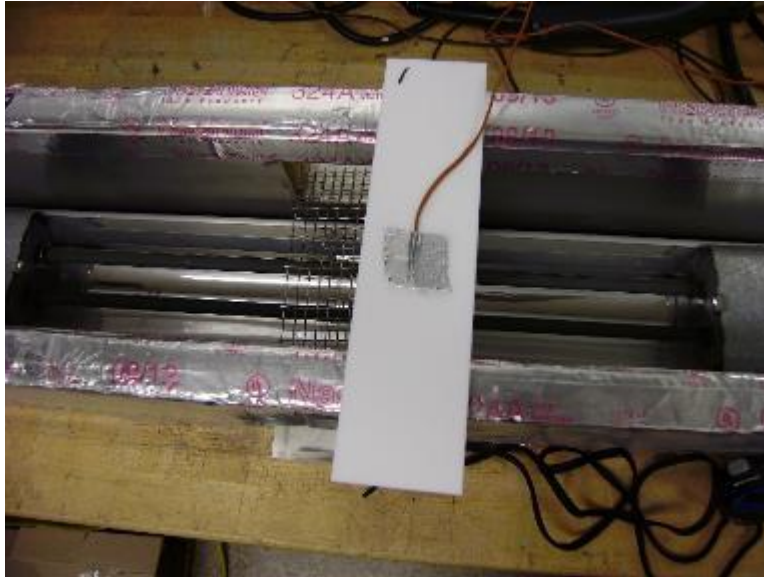


Photo No. 7
NEMA LD 3.10 Radiant Heat Resistance - Test Setup

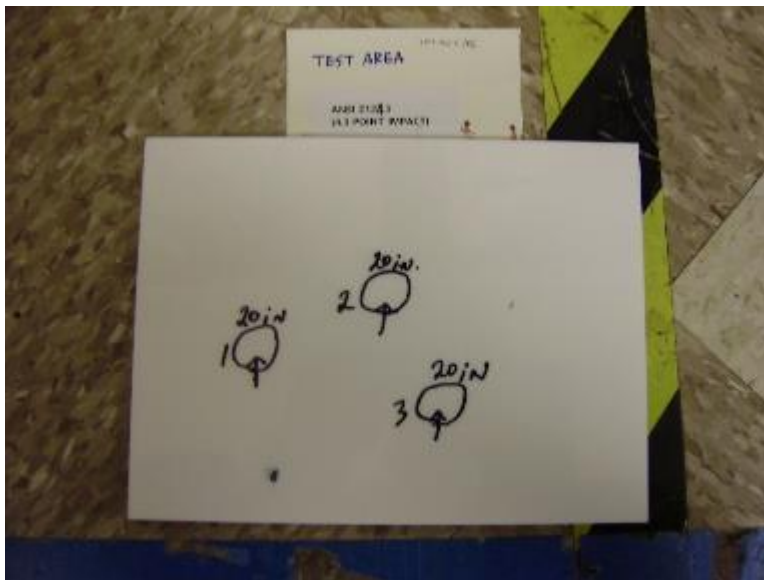


Photo No. 8
ANSI Z124.3 Sec. 4.3 Point Impact - Test Result

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Photo No. 9

ANSI Z124.3 Sec. 5.2 Stain Resistance Test - Black Crayon-Pre-Test



Photo No. 10

**ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Black Crayon - Post-Test, After Cleaning**

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Photo No. 11

**ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Black Liquid Shoe Polish Pre-Test**



Photo No.12

**ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Black Liquid Shoe Polish Post-Test After Cleaning**

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Photo No. 13

ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Blue Washable Ink Pre-Test



Photo No. 14

ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Blue Washable Ink Post-Test After Cleaning

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Photo No. 15

ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Violet Solution Pre-Test



Photo No. 16

ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Violet Solution Post-Test After Cleaning

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Photo No. 17

**ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Iodine Solution Pre-Test**



Photo No. 18

**ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Iodine Solution Post-Test After Cleaning**

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Photo No. 19
ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Lipstick Pre-Test



Photo No. 20
ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Lipstick Post-Test After Cleaning

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Photo No. 21
ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Hair Dye Pre-Test



Photo No. 22
ANSI Z124.3 Sec. 5.2 Stain Resistance Test
Hair Dye Post-Test

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Photo No. 23

ANSI Z124.3 Sec. 5.3 Wear and Cleanability Test - In Progress

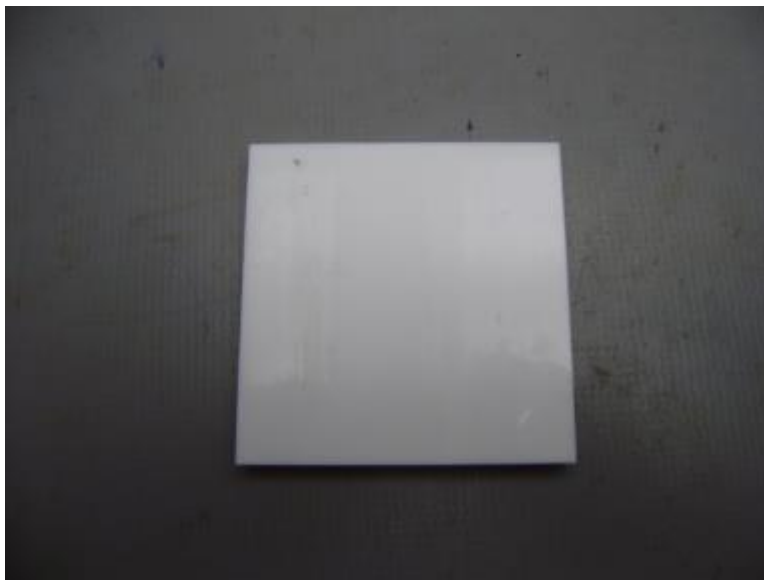


Photo No. 24

ANSI Z124.3 Sec. 5.3 Wear and Cleanability Test - Test Result

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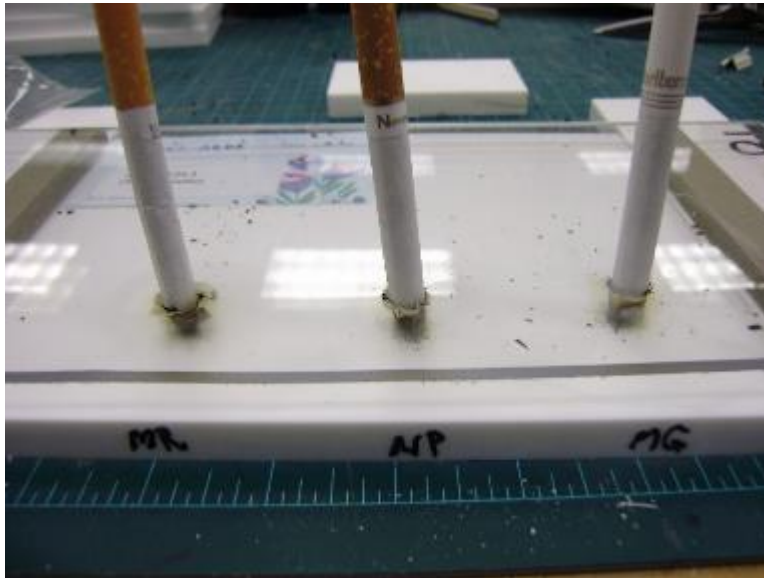


Photo No. 25

ANSI Z124.3 Sec. 5.4 Cigarette Test - Test Setup



Photo No. 26

ANSI Z124.3 Sec. 5.4 Cigarette Test - Post-Test

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Photo No. 27

**ANSI Z124.3 Sec. 5.4 Cigarette Test - Post-Test
After Sanding With 400 Grit Sandpaper**



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