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SUBJECT: Results of Testing Performed in Accordance with IICL Specification; KTA-Tator, Inc. Project No. 66075135 (TO)

Dear Wu Yanjun:

In accordance with KTA-Tator, Inc. (KTA) QN385 and the advanced wire transfer payment received March 17, 2023, KTA has tested two coating systems, one exterior coating system and one interior coating system, in accordance with the general and detailed procedures of the Institute of International Container Lessors (IICL) Specification (August 16, 1994). This report contains details of the testing procedures employed and the results of the corrosive, cosmetic, and mechanical evaluations conducted on the specimens.

SUMMARY

Two Foshan To Easy Powder Coating Material Co., Ltd coating systems, one exterior and one interior, were tested in accordance with the regimes outlined in the IICL Specification (August 16, 1994). For exterior systems, IICL suggests a minimum of 55 points for the corrosive group tests (out of a possible 70), 15 points minimum for the mechanical group tests (out of a possible 25), and no minimum score (out of a possible 5) for the cosmetic group tests. For interior systems, IICL suggests a minimum of 40 points for the corrosive group tests (out of a possible 55), and 30 points minimum for the mechanical group tests (out of a possible 45); there is no cosmetic testing for interior systems. The corrosive group tests include degree of blistering, degree of rusting, and undercutting, which are rated after accelerated weathering/corrosion exposure. The mechanical group tests include adhesion and impact resistance (both rated after exposure), and abrasion (for interior systems only, unexposed). The cosmetic group tests include color and gloss changes after exposure (for exterior systems only). Both exterior and interior systems met the minimum requirements listed in the IICL Specification. Individual data for each of the tests conducted is provided in Tables 3 through 10. The numerical scores for each system are provided in Table 1, "Test Scores for Coating Systems According to IICL Specification."

Table 1 – Test Scores for Coating Systems According to IICL Specification

Panel IDs	Product (Code), Product Name, & DFT	Coating Type	Corrosive Group Points	Mechanical Group Points	Cosmetic Group Points	Total Points
TOI-131, 32, 67, 166, 265, 364, 463, 562, 661, 760, 859, 958, 1057, 1156, and TOI-1255	30114D – Epoxy Powder Primer, 42-47µm 30115D – Epoxy Powder Topcoat, 46-55µm	Interior	53	43.5	Not Applicable	96.5
TOE-151 through TOE 165	30114D – Epoxy Powder Primer, 48-55µm TY75255M – Polyester Powder Topcoat, 49-55µm	Exterior	67	23	5	95

NOTE: Epoxy Resin supplier of the above coating systems is Guangzhou Zhihai Industrial Co., Ltd

SAMPLES

The coated samples listed in Table 2, "Samples" were received by KTA from Foshan To Easy Powder Coating Material Co., Ltd on March 9, 2023. It should be noted that at no time did KTA personnel witness the manufacturing, acquisition, or application of the samples.

Table 2 – Samples

Client ID	Sample Description
TOI-131, 32, 67, 166, 265, 364, 463, 562, 661, 760, 859, 958, and TOI-1057	Thirteen (13) steel panels measuring 4" x 6" x 3/16" coated light gray on both sides with Sample ID on front (Interior)
TOI-1156 and TOI-1255	Two (2) steel Taber abrasion panels measuring 4" x 4" x 3/16" coated light gray with Sample ID on front (Interior)
TOE-151 through TOE-165	Fifteen (15) steel panels measuring 4" x 6" x 3/16" coated gray on both sides with Sample ID on front (Exterior)

LABORATORY INVESTIGATION

For the two prepared coating systems (one exterior and one interior), the laboratory investigation consisted of cyclic weathering, degree of blistering, degree of rusting, undercutting, adhesion, impact resistance, abrasion resistance (interior system only), and color and gloss testing (exterior system only) in accordance

with the test procedures outlined in the IICL Specification (August 16, 1994). Descriptions of the testing procedures employed, and results of the testing are provided below.

Cyclic Weathering

The exterior coating system was subjected to eight exposure cycles as outlined in the IICL Specification. First, the panels were exposed in a QUV Accelerated Weathering Tester (QUV model) manufactured by Q-Lab Corporation. An uninsulated black panel thermometer was mounted on a solid surface at the center position of the panel rack. The samples were mounted in aluminum frames. The average bulb-to-specimen distance for the cabinet was 55 mm. There are two banks of lamps in a cabinet, each containing four lamps with ages near 1400, 1000, 600, and 200 hours ± 200 hours. The oldest lamps are replaced approximately every 400 hours, and the positions of the remaining lamps were rotated. The irradiance was checked approximately every 800 lamp hours. Interruptions were minimal and occurred for less than 15 minutes. Daily records were maintained by KTA and are available upon request. Each UV cycle consisted of eight hours ultraviolet light exposure set at a temperature of 60°C using UVA 340 bulbs (0.89 W/m² typical irradiance, non-controlled), followed by four hours of condensing humidity set at a temperature of 50°C, as per ASTM G154-23, "Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials", Cycle 1. This 12-hour sub-cycle was repeated six times, for a total of 72 hours. Following the ultraviolet light/humidity exposure, the panels were placed into a Q-Fog CCT Cyclic Corrosion Tester cabinet (also manufactured by Q-Lab Corporation) and subjected to 96 hours of Prohesion cycling using a solution of 0.35% (wt/wt) ammonium sulfate and 0.05% (wt/wt) sodium chloride in reverse-osmosis filtered and deionized water with a pH of 5.0 – 5.4. Each Prohesion cycle consisted of four hours of fog set at 30°C and two hours of dry air purge set at 40°C; this sub-cycle, a modified version of ASTM G85-19, "Standard Practice for Modified Salt Spray (Fog) Testing", Annex A5, was repeated 16 times. This regime constituted one complete cycle and was repeated seven more times over a total of 56 days.

The interior coating system was subjected to the same regimen as the exterior coating system, except the ultraviolet light/humidity exposure portion was replaced with eight hours of dry and dark conditions in a Q-Fog CCT cabinet set at 60°C followed by four hours of condensing humidity set at 60°C. Within approximately one hour of completion of the exposure, the panels were subjected to various tests as outlined below.

Degree of Blistering (Corrosive Group)

One panel from each system was evaluated for degree of blistering in accordance with ASTM D714-02(17), "Standard Test Method for Evaluating Degree of Blistering of Paints." The values obtained from the IICL specification from the associated blistering rating were multiplied by 0.75 for the exterior system and 1.00 for the interior system to achieve the corresponding point values reported. The results of the blistering determinations and corresponding point values are provided in Table 3, "Results of Degree of Blistering Determinations."

Table 3 – Results of Degree of Blistering Determinations

Panel ID	Coating System	Degree of Blistering Rating	IICL Unit Value	Corresponding Point Value
TOI-67	Interior	10	20	20
TOE-155	Exterior	10	20	15

Degree of Rusting (Corrosive Group)

One panel from each system was evaluated for degree of rusting in accordance with ASTM D610-08(19), "Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces." For the degree of rusting determination, the values obtained from the IICL specification were multiplied by 2.50 for the exterior system and 1.50 for the interior system to achieve the corresponding point values reported. The results of the rusting determinations and corresponding point values are provided in Table 4, "Results of Degree of Rusting Determinations."

Table 4 – Results of Degree of Rusting Determinations

Panel ID	Coating System	Degree of Rusting Rating	IICL Unit Value	Corresponding Point Value
TOI-166	Interior	10	10	15
TOE-156	Exterior	10	10	25

Undercutting (Corrosive Group)

Prior to undergoing cyclic weathering, two panels from each system were scribed with two scribe lines each through the coating layers using a tungsten carbide, thread-cutting lathe tool bit with a cutting tip having a 60° included angle in order to expose the substrate, as outlined in the IICL Specification. A tool bit conforming to ANSI B94.50, Style E has been found to meet the requirements of ASTM D1654-08(16)e1, "Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments" for the scribe requirements.

After undergoing the eight complete exposure cycles, the scribed panels from each system were evaluated for undercutting in accordance with the IICL Specification, a modified ASTM D1654 procedure. The IICL unit value was determined based on the amount of scribe creep from the table and instructions provided in the specification. The unit value was multiplied by 3.00 for the exterior system and 2.00 for the interior system to obtain the corresponding point values reported in Table 5, "Results of Undercutting Determinations."

Table 5 – Results of Undercutting Determinations

Panel ID	Coating System	Average Scribe Creep (mm)	IICL Unit Value	Corresponding Point Value
TOI-265 and 364	Interior	2.8	9	18
TOE-157 and 158	Exterior	0.7	9	27

Adhesion (Mechanical Group)

One panel from each system was evaluated for adhesion in accordance with ASTM D3359-23, Method B, "Standard Test Methods for Measuring Adhesion by Tape Test" using a 2-mm cross-cut guide. For the adhesion determinations, the unit value is equal to the corresponding point value. The results of the adhesion determinations and corresponding point values are provided in Table 6, "Results of Adhesion Determinations."

Table 6 – Results of Adhesion Determinations

Panel ID	Coating System	Adhesion Rating	IICL Unit Value	Corresponding Point Value
TOI-463	Interior	5B	15	15
TOE-159	Exterior	5B	15	15

Impact Resistance (Mechanical Group)

Two panels from each system were tested for impact resistance, one in direct and one in reverse orientation, in accordance with ASTM D2794-93(19), "Standard Test Method for Resistance of Organic Coating to the Effects of Rapid Deformation (Impact)." A low-voltage holiday detector was used to inspect for cracking at the impact location. Unit values were assigned in accordance with tables in the IICL Specification. The unit values were multiplied by 0.50 for the exterior system and by 0.75 for the interior system to obtain the corresponding point values for each impact test. The results of the impact tests and corresponding point values are provided in Table 7, "Results of Direct Impact Testing," and Table 8, "Results of Reverse Impact Testing."

Table 7 – Results of Direct Impact Testing

Panel ID	Coating System	Direct Impact Result (inch-pounds)	IICL Unit Value	Corresponding Direct Impact Point Value
TOI-958	Interior	50	10	7.5
TOE-164	Exterior	60	10	5

Table 8 – Results of Reverse Impact Testing

Panel ID	Coating System	Reverse Impact Result (inch-pounds)	IICL Unit Value	Corresponding Reverse Impact Point Value
TOI-32	Interior	15	8	6
TOE-153	Exterior	10	6	3

Abrasion Resistance (Mechanical Group)

One panel from the interior system was tested for abrasion resistance in accordance with ASTM D4060-19, "Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser," employing 500-gram weights and CS-17 wheels for 1,000 revolutions. The weight loss was determined and was assigned a corresponding point value. The points for this test are equal to the unit value, and the results are provided in Table 9, "Results of Abrasion Resistance Testing."

Table 9 – Results of Abrasion Resistance Testing

Panel ID	Coating System	Weight Loss (mg)	Corresponding Point Value (IICL Unit Value)
TOI-1156	Interior	21.1	15

Color and Gloss (Cosmetic Group)

The color and gloss of one sample from the exterior system was measured both before and after exposure in accordance with ASTM D2244-21, "Standard Practice for Calculation of Color Tolerance and Color Difference from Instrumentally Measured Color Coordinates," and ASTM D523-14(18), "Standard Test Method for Specular Gloss." The color was measured using a BYK spectro-guide 45/0 gloss spectrophotometer. The CIE L*a*b* color scale was used with the daylight illuminant (D65) and the 10° standard observer. The L* value corresponds to the lightness of the sample with a value of 100 corresponding to pure white. The a* value indicates red when positive and green when negative; the b* value indicates yellow when positive and blue when negative. Gloss measurements were obtained using a BYK-Gardner micro-TRI-gloss meter using the 60° mode. Three color readings and eight gloss readings (four compass directions at two spots) were obtained on the sample.

The IICL unit values for color and gloss were equal to the corresponding point values reported. The results of the cosmetic group determinations, the color difference (ΔE^*_{ab} calculation) result and corresponding point values are provided in Table 10, "Results of Color and Gloss Determinations.

Table 10 – Results of Color and Gloss Determinations

Panel ID	Color		Color Difference (ΔE^*_{ab})	Corresponding Color Point Value (IICL Unit Value)	Panel ID	Gloss 60°		Percent Gloss Change (%)	Corresponding Gloss Point Value (IICL Unit Value)
	Pre-Exposure	Post-Exposure				Pre-Exposure	Post-Exposure		
TOE-151	L* 61.87 a* -1.66 b* -2.68	L* 62.06 a* -1.91 b* -1.30	1.41	3	TOE-152	92.4	88.4	- 4.3	2

If you have any questions or comments regarding this report, please contact me by telephone at 412.746-4284, or by email at cquatman@kta.com.

Sincerely,

KTA-TATOR, INC.

Chad S. Quatman
Project Manager/Coatings Application Specialist

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