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KTA-TATOR, INC.

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December 22, 2011

Via Email: jwang@wnsimage.com

Mr. Jianguo Wang
ANCATT Company
20 Findail Drive
Newark, DE 19711

**SUBJECT: Results of Exposure Testing and Adhesion Testing;
KTA-Tator, Inc. Project No. 290260-A1-R1**

Dear Mr. Wang:

In accordance with KTA-Tator, Inc. (KTA) Proposal PN090312 and subsequent signed Authorization to Proceed dated April 17, 2009, KTA has completed salt fog exposure testing of coated panels following up to 13,740 hours of salt fog exposure. Tensile adhesion testing of one (1) coated panel was conducted following 8,372 hours salt fog exposure and of three (3) coated panels following 1,000 hours cyclic weathering exposure. KTA has also completed cyclic weathering exposure testing of coated panels following up to 8,500 hours of cyclic weathering exposure. This test report contains a description of the testing procedures as well as the results of the inspections performed to date.

TEST SPECIMENS

The test specimens were prepared by ANCATT Company (ANCATT). All panels were coated white on one side with identification markings on the backside. It should be noted that KTA did not witness the preparation of the specimens.

The samples were scribed on the unlabeled side by KTA with a single line down the center (lengthwise) of each panel, extending to approximately one (1) inch from the edges. The scribing tool used was a tungsten carbide thread cutting lathe tool bit with a cutting tip having a 60° included angle as described in ASTM D 1654, "Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments." The specimens were protected on the backsides with acrylic coating, and the edges of each panel were protected from edge effects with vinyl electrical tape.

SALT FOG EXPOSURE

The panels designated for salt fog exposure testing were exposed in accordance with ASTM B 117, "Standard Practice for Operating Salt Spray (Fog) Apparatus." The samples were positioned with the scribed surface facing parallel to the primary direction of air flow within the cabinet.

The exposure temperature within the cabinet was maintained at 92 to 98°F. The quantity of fog condensate collected inside the chamber was maintained at 1.0 to 2.0 milliliters per hour for each 80 cm² of horizontal collecting area. The fog consisted of 5% Morton Culinox® 999® salt in deionized water conforming ASTM D 1193. The pH and specific gravity of the fog condensate were 6.5 to 7.2 and 1.025 to 1.040, respectively. Daily records of temperature as well as condensate salinity and pH are maintained by KTA and are available upon request.

CYCLIC WEATHERING EXPOSURE

The panels designated for cyclic weathering exposure were exposed in accordance with ASTM D 5894, "Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)."

The specimens were exposed to alternating periods of seven (7) days in a QUV Accelerated Weathering Tester manufactured by QLab Corporation and seven (7) days in a Q-Fog Cyclic Corrosion Tester, Model CCT 600 also manufactured by QLab Corporation. The UV-condensation cycle consisted of four (4) hours ultraviolet light exposure at 60° C (UVA-340 lamps) and four (4) hours water condensation at 50° C. The Q-Fog fog/dry cycle was one (1) hour of fog at ambient temperature (approx. 23° C) and one (1) hour dry-off at 35° C. The fog consisted of a solution of 0.05% sodium chloride and 0.35% ammonium sulfate with a pH of 5.1 to 5.4.

SPECIMEN EVALUATION

At specified intervals, the specimens were removed from exposure and immediately rinsed with deionized water and evaluated for visible changes in the appearance of the coatings. The panels were rated for blistering in accordance with ASTM D 714, "Standard Test Method for Evaluating Degree of Blistering of Paints," and rusting in accordance with ASTM D 610, "Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces." For each method, the rating scale ranges from 0 to 10, with a rating of 10 indicating no blistering or rusting. Subsequential ratings numbers represent progressively larger blisters and rusted areas. Degree of blistering is additionally rated according to frequency (Dense, Medium Dense, Medium, and Few). The panels were rated visually for the amount of undercutting extending from the scribe. The scribe was not destructively evaluated so that exposure could be continued following the evaluations. The scribe lines of Panels II-91-6 and II-91-10 were scraped prior to the evaluation at 8,372 hours, and continued exposure to 12,740 hours. The scribe lines of Panels II-19, II-91-2, and II-91-7 were scraped following exposure. Digital photographs were obtained of the samples following inspections and are contained in the Photographic Appendix following this report. The results of the evaluations are contained in Tables 1, 2, and 3, below.

Table 1 – Results of Visual Inspections Following Salt Fog Exposure Under 5000 Hours

Exposure Duration (Hours)	Sample ID	Blistering Rating	Rusting Rating	Undercutting Distance (mm)	Other Visually Observed Changes in Appearance
1000	II-91-3	10	10	0 – 3	None
	II-91-5	10	10	<1 – 1	None
2000	II-46-3	10	10	1 – 3	None
	II-46-5	10	10	1 – 3	None
3000	II-91-1	10	10	1 – 4	None
	II-91-9	10	10	1 – 3	None
	II-91-18	10	10	<1 – 3.5	None
	II-53-12+	10	10	0 – 1	None
4500	II-91-11+	10	10	0 – 5	None

+ *Aluminum Substrate***Table 2 – Results of Visual Inspections Following Salt Fog Exposure Over 5000 Hours**

Exposure Duration (Hours)	Sample ID	Blistering Rating	Rusting Rating	Undercutting Distance (mm)	Other Visually Observed Changes in Appearance
5000	II-19	10	10	1 - 4	None
7500	II-53-9	10	10	3 - 8	None
8372	II-91-2	10	10	3 (scraped prior to evaluation)	None
	II-91-7	10	10	3 (scraped prior to evaluation)	None
12740	II-91-4	10*	10	1 – 5	None
	II-91-6	10	10	1 – 4 (2 when scraped at 8372 hours)	None
	II-91-8	10	10	3 - 6	None
	II-91-10	10**	10	1 – 6 (3 when scraped at 8372 hours)	None
13740	II-53-5	10***	10	2 - 7	None
	II-53-8	10	10	1 - 9	None
10740	II-91-16+	10	10	0	None

* *One (1) No.2 size blister*** *Two (2) No.8 size blisters**** *Two (2) No.2 size blisters*+ *Aluminum substrate*

Table 3 – Results of Visual Inspections Following Cyclic Weathering Exposure

Exposure Duration (Hours)	Sample ID	Blistering Rating	Rusting Rating	Undercutting Distance (mm)	Other Visually Observed Changes
1500	III-91-12	10	10*	2 – 6	None
	III-92-10	10	10*	1 – 3	None
2500	III-30-2	10	10	0 – 2	None
6500	II-91C-6	10	10	7 – 16	None
	II-91C-7+	10	10	0 – 10	None
	II-91C-11+	10	10	0 – 7	None
	II-91C-12+	10	10*	0 – <1	None
7500	II-53C-8	10	10	0 – 10	None
	III-11-B	10	10*	1 – 5	None
	III-11-C	10	10	5 – 9	None

* *Rusting was present but was less than 0.01%*

+ *Aluminum substrate*

ADHESION TESTING FOLLOWING EXPOSURE

Tensile adhesion (pull-off strength) was measured on one (1) coated sample following 8,372 hours salt fog exposure and on three (3) coated panels following 1,000 hours cyclic weathering exposure. The adhesion was rated in accordance with ASTM D 4541, “Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers,” Annex A4, “Self-Aligning Adhesion Tester Type IV.” The testing surfaces were wiped clean and abraded gently using fine sandpaper. Pull stubs with an abraded test surface were attached to the coating using a two-component epoxy adhesive (Araldite 2011), which was allowed to cure for twenty-four (24) hours at ambient laboratory conditions. The pull-stubs were then detached using a self-alignment pneumatic adhesion tester (PATTI-Pneumatic Adhesion Tensile Testing Instrument) employing the F-2 and F-4 piston. The force (in psi) required to remove each pull-stub was recorded along with the location of break and approximate percentage of each. The location of break is defined as adhesive (a split between layers), cohesive (within a layer), or glue failure (coating strength exceeds glue strength). The results of the testing can be found in Tables 4 and 5, “Results of Adhesion Strength Testing Following 8372 Hours Salt Fog Exposure (ASTM D 4541),” and “Results of Adhesion Strength Testing Following 1000 Hours Cyclic Weathering Exposure (ASTM D 4541),” respectively.

Table 4 – Results of Adhesion Strength Testing Following 8372 Hours Salt Fog Exposure (ASTM D 4541)

Sample ID	Pull Stub	Piston	Pull-Off Strength (psi)	Location of Break	Average Pull-Off Strength
II-91-2	A	F-2	387	30% adhesive to substrate, (20% corrosion present on substrate), 70% cohesive within gray layer	564
	B	F-4	570	5% adhesive to substrate, 70% cohesive within gray layer, 25% cohesive within white layer	
	C	F-2	734	50% cohesive within white layer, 45% cohesive within gray layer, 5% glue failure	

**Table 5 – Results of Adhesion Strength Testing
Following 1000 Hours Cyclic Weathering Exposure
(ASTM D 4541)**

Sample ID	Pull Stub	Pull-Off Strength (psi)	Location of Break	Average Pull-Off Strength
II-17B	A	611	100% cohesive failure within primer	652 psi
	B	734	80% cohesive failure within primer, 20% glue failure	
	C	611	100% cohesive failure within primer	
II-18	A	815	70% cohesive failure within primer, 30% glue failure	849 psi
	B	877	90% cohesive failure within primer, 10% glue failure	
	C	856	100% cohesive failure within primer	
II-18B	A	673	80% cohesive failure within primer, 20% glue failure	812 psi
	B	1009	100% cohesive failure within primer	
	C	754	30% cohesive failure within primer, 70% glue failure	

X-cut adhesion was also measured on one (1) sample following 8,372 hours salt fog exposure. Adhesion testing was performed in accordance with ASTM D 3359, “Measuring Adhesion by Tape Test.” Briefly, this method entails cutting an “X” (Method A) or a cross-cut pattern (Method B) into the surface of the coating, applying adhesion tape (Permacel 99) then quickly removing the tape and rating the degree of coating removal on a scale of 0 to 5, with 0 indicating greater than 65% removal of coating and 5 indicating no removal of coating. The results of the testing can be found in Table 6, “Results of Adhesion Strength Testing Following 8372 Hours Salt Fog Exposure (ASTM D 3359).”

**Table 6 – Results of Adhesion Strength Testing Following 8372 Hours Salt Fog Exposure
(ASTM D 3359)**

Sample ID	Trial	Rating
II-91-2	1	5A
	2	5A
	3	5A

If you have any questions concerning the testing or this report, please call me by telephone at 412.788.1300 extension 181, or by email at cmcgee@kta.com.

Very truly yours,

KTA-TATOR, INC.



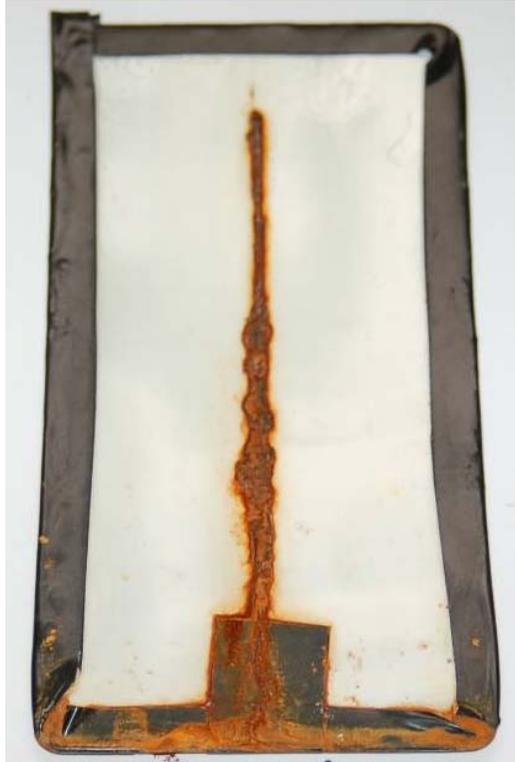
Carly M. McGee
Physical Laboratory Supervisor

CMM/RNR:kdw
Appendix: Photographs
JN290260-A1
(290260-A1 ANCATT.doc)

R1 – An revision was issued to make editorial corrections.

NOTICE: This report represents the opinion of KTA-TATOR, INC. This report is issued in conformance with generally accepted industry practices. While customary precautions were taken to verify the information gathered and presented is accurate, complete and technically correct, this report is based on the information, data, time, materials, and/or samples afforded. This report should not be reproduced except in full.

PHOTOGRAPHIC APPENDIX



Panel II-19 – 5000 Hours Salt Fog Exposure



Panel II-19 – 5000 Hours Salt Fog Following Scraping



Panel II 53-9 – 5672 Hours Salt Fog Exposure



Panel II-53-9 – 7500 Hours Salt Fog Exposure



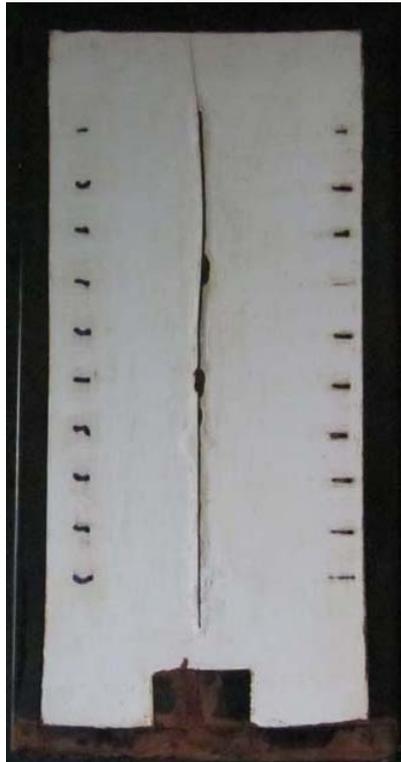
Panel II-91-2 – 4672 Hours Salt Fog Exposure



Panel II-91-2 – Following 8372 Hours Salt Fog Exposure and Adhesion Testing



Panel II-91-7 – 4672 Hours Salt Fog Exposure



Panel II-91-7 – Following 8372 Hours Salt Fog Exposure and Scraping



Panel II-91-4 – 4672 Hours Salt Fog Exposure



Panel II-91-4 – 9404 Hours Salt Fog Exposure



Panel II-91-4 – 12740 Hours Salt Fog Exposure



Panel II-91-6 – 4672 Hours Salt Fog Weathering



Panel II-91-6 – 9404 Hours Salt Fog Exposure (Scraped at 8372 Hours)



Panel II-91-6 – 11420 Hours Salt Fog Exposure (Scraped at 8372 Hours)



Panel II-91-10 – 4672 Hours Salt Fog Exposure



Panel II-91-10 – 9404 Hours Salt Fog Exposure (Scraped at 8372 Hours)



Panel II-91-10 – 11420 Hours Salt Fog Exposure (Scraped at 8372 Hours)



Panel II-53-5 – 5672 Hours Salt Fog Exposure



Panel II-53-5 – 10404 Hours Salt Fog Exposure



Panel II-53-5 – 13740 Hours Salt Fog Exposure



Panel II-53-8 – 5672 Hours Salt Fog Exposure



Panel II-53-8 – 10404 Hours Salt Fog Exposure



Panel II-53-8 – 13740 Hours Salt Fog Exposure



Panel II-91-16 – 7404 Hours Salt Fog Exposure

Note that red corrosion products are contamination from an adjacent sample in the exposure cabinet and not corrosion of the substrate.



Panel II-91-16 – 10740 Hours Salt Fog Exposure

Note that red corrosion products are contamination from an adjacent sample in the exposure cabinet and not corrosion of the substrate.