



273 Industrial Dr. ♦ Hillsdale, MI 49242 ♦ Phone: (517) 439-1485 ♦ Fax: (517) 439-1652

**AMERICAN IRON AND STEEL INSTITUTE**

**JL SPECIALTY STEEL INCORPORATED**

1200 Midland Avenue  
Midland, PA 15059

ATTN: Brett Christman

Cyclic Corrosion Test  
(SAE J2334-1998)

ACT Quote Number: AQT 37386  
ACT Project Number: AIN 124658F (Rev. 1)

Material: Customer Supplied and Prepared Fuel Tank Samples  
Austenitic 304L + pre-paint (Neukote)

Prepared By: KWW and JHC  
Date Prepared: 07/07/03  
Logbook: RTC-16 pp. 19-39

APPROVED BY:

A handwritten signature in black ink that reads "Kevin Wendt". The signature is written over a faint, pinkish-red watermark of the ACT logo.

Kevin Wendt  
Technical Manager



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**LABORATORY TEST REPORT**

**ACT PROJECT AIN124658F (Rev. 1)**

**Material ID:** 11 = Austenitic 304L + pre-paint (Neukote)

**Evaluation #1:** Cyclic Corrosion Resistance Test  
AQT 37386: Per Line Items #3-#7 of Quotation  
Material Received: 01/29/02, 01/31/02, 02/01/02, 02/04/02, 02/05/02, 02/11/02, 02/13/02, 02/14/02, 02/19/02, 02/25/02  
Test Start Date: 03/05/02  
Test End Dates: 06/24/02 (80 Cycles)  
08/19/02 (120 Cycles)  
10/14/02 (160 Cycles)

Test Methods: ASTM D 1654-00  
SAE J2334 (JUN98)

Scribing Tool: Straight-shank Type E Lathe Tool

Exposures: 80, 120 and 160 Cycles (2 samples of each material removed at 80 and 120 Cycles)

One Cycle: 6 Hours Humid Stage ( $50 \pm 2^{\circ}\text{C}$  Condensing Humidity)  
15 Minutes Salt Application Stage  
17.75 Hours Dry Stage ( $60 \pm 2^{\circ}\text{C}/50 \pm 5\%$  Relative Humidity)

Salt Solution: 0.5% NaCl + 0.1% CaCl<sub>2</sub> + 0.075% NaHCO<sub>3</sub>

Procedure: Samples are scribed per customer instructions. Samples are exposed per Evaluation #2 prior to exposure. At every 20 Cycles, samples are removed from test, rated for corrosion, digitally photographed, exposed per Evaluation #2, digitally photographed and returned to test.

Digital Calipers: Mitutoyo Digital Calipers (ACT #114)

Micrometer: Digitrix-Mark II Micrometer (ACT #413)

Scale: Mettler 3MPT-K (ACT #95)



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- Evaluations: Visual examination for corrosion and loss of adhesion at scribe, chipped area, Olsen dome, flange (including weld and clip locations), and field (area above and around dome) per Degree of Change at 80, 120, and 160 cycles after air blow-off. Initial and final panel weight at 80, 120, and 160 cycles. Creepback from Scribe after 80, 120, and 160 cycles. Report Maximum Pit Depth (if greater than 0.1 mm) of each sample at 80, 120, and 160 cycles . Chip Rating at every 20 cycles per Evaluation #2.
- Degree of Change: N = None: No corrosion  
S = Slight: Approximately less than 15% corrosion  
M = Moderate: Approximately 15-30% corrosion  
P = Pronounced: Approximately greater than 30% corrosion
- Air Blow-Off Procedure: Holding the nozzle at approximately a 45° angle, blow along the entire panel surface at 80 psi, disturbing the surface mechanically by the air nozzle to ensure an opening for the air blast.
- Creepback from Scribe: The distance of the affected paint film between the scribed line and the unaffected paint film.
- Average: The mean of 6 measurements of creepback from the scribe, at points 10 mm apart centered on the scribed line. Each measurement is an average of the creepback on two sides of the scribed line.
- Maximum: A measurement of the creepback from the scribe, at the point with the most extensive amount of affected paint, discounting the areas less than one centimeter from the ends of the scribed line.
- Minimum: A measurement of the creepback from the scribe, at the point with the least extensive amount of affected paint, discounting the areas less than one centimeter from the ends of the scribed line.
- g: Grams
- mm: Millimeter



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**Evaluation #2:** Gravelometer Test  
 AQT 37386: Per Line Item #10 of Quotation  
 Material Received: 01/29/02, 01/31/02, 02/01/02, 02/04/02, 02/05/02, 02/11/02, 02/13/02, 02/14/02, 02/19/02, 02/25/02  
 Test Dates: 04/01/02, 04/29/02, 05/27/02, 06/24/02, 07/22/02, 08/19/02, 09/16/02  
 Test Method: SAE J400 (JAN85) Method II  
 Test Apparatus: QGR Gravelometer (ACT #98)  
 Test Conditions: Room Temperature, Air Pressure 70 ± 3 psi  
 Gravel: 1 pint water worn road gravel that passes through a 16 mm (5/8 in.) space screen, but is retained on a 9.5 mm (3/8 in.) space screen.  
 Evaluation: Visual comparison of samples with SAE J400 pictorial standards  
 Chip Ratings: A number-letter combination in which rating numbers 10-0 indicate the number of chips of each size and rating letter A-D designate the sizes of the corresponding chips. Level of failure notation is included to further refine the description.  
 Number Ratings:

Rating Number	Number of Chips	Rating Number	Number of Chips
10	0	4	50-74
9	1	3	75-99
8	2-4	2	100-149
7	5-9	1	150-250
6	10-24	0	>250
5	25-49		

Size Ratings:

Rating Letter	Size of Chips
A	<1mm (approximately 0.03 in)
B	1-3 mm (approximately 0.03-0.12 in)
C	3-6 mm (approximately 0.12-0.25 in)
D	>6 mm (>approximately 0.25)



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**LABORATORY TEST REPORT**

**ACT PROJECT AIN124658F (Rev. 1)**

**Cyclic Corrosion Test Data: 80 Cycles per SAE J2334**

ID	Dome		Scribe		Chip		Field		Flange		Flange (Under Clip)		Weld		Weld (Under Clip)		Loss of Adhesion
	White	Red	White	Red	White	Red	White	Red	White	Red	White	Red	White	Red	White	Red	
11-1	N	N	N	N	N	S	N	N	N	S	N	S	N	S	N	S	None
11-2	N	N	N	S	N	S	N	N	N	S	N	N	N	S	N	N	None

**Cyclic Corrosion Test Data: 120 Cycles per SAE J2334**

ID	Dome		Scribe		Chip		Field		Flange		Flange (Under Clip)		Weld		Weld (Under Clip)		Loss of Adhesion
	White	Red	White	Red	White	Red	White	Red	White	Red	White	Red	White	Red	White	Red	
11-3	N	N	N	S	N	S	N	N	N	S	N	S	N	S	N	S	None
11-4	N	N	N	S	N	S	N	N	N	S	N	S	N	S	N	S	None

**Cyclic Corrosion Test Data: 160 Cycles per SAE J2334**

ID	Dome		Scribe		Chip		Field		Flange		Flange (Under Clip)		Weld		Weld (Under Clip)		Loss of Adhesion
	White	Red	White	Red	White	Red	White	Red	White	Red	White	Red	White	Red	White	Red	
11-5	N	N	N	S	N	S	N	N	N	S	N	S	N	M	N	S	None
11-6	N	N	N	S	N	S	N	S	N	S	N	N	N	S	N	S	None

(Rust staining not included in ratings)



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**LABORATORY TEST REPORT****ACT PROJECT AIN124658F (Rev. 1)**Weight Change Test Data: **80 Cycles per SAE J2334**

<u>ID</u>	<u>Initial Weight</u>	<u>Final Weight</u>	<u>Change</u>
11-1	297.1 g	295.9 g	-1.2 g
11-2	295.9	294.7	-1.2

Weight Change Test Data: **120 Cycles per SAE J2334**

<u>ID</u>	<u>Initial Weight</u>	<u>Final Weight</u>	<u>Change</u>
11-3	298.1 g	297.2 g	-0.9 g
11-4	298.6	297.7	-0.9

Weight Change Test Data: **160 Cycles per SAE J2334**

<u>ID</u>	<u>Initial Weight</u>	<u>Final Weight</u>	<u>Change</u>
11-5	297.4 g	296.1 g	-1.3 g
11-6	297.8	296.5	-1.3



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**LABORATORY TEST REPORT**

**ACT PROJECT AIN124658F (Rev. 1)**

Creepback from Scribe and Pit Depth Test Data: **80 Cycles per SAE J2334**

ID	Creepback from Scribe			Maximum Pit Depth
	Average	Minimum	Maximum	
11-1	0.0 mm	0.0 mm	0.0 mm	** mm
11-2	0.0	0.0	0.0	**

Creepback from Scribe and Pit Depth Test Data: **120 Cycles per SAE J2334**

ID	Creepback from Scribe			Maximum Pit Depth
	Average	Minimum	Maximum	
11-3	0.0 mm	0.0 mm	0.0 mm	** mm
11-4	0.0	0.0	0.0	**

Creepback from Scribe and Pit Depth Test Data: **160 Cycles per SAE J2334**

ID	Creepback from Scribe			Maximum Pit Depth
	Average	Minimum	Maximum	
11-5	0.0 mm	0.0 mm	0.0 mm	** mm
11-6	0.0	0.0	0.0	**

\*\* No Measurable Pit Depth (< 0.1 mm)



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Gravelometer Test Data: **80 Cycles per SAE J2334**

ID	20 Cycles		40 Cycles		60 Cycles		80 Cycles	
	Rating	Level of Failure	Rating	Level of Failure	Rating	Level of Failure	Rating	Level of Failure
11-1	10	None	10	None	10	None	8A	S/T*
11-2	10	None	10	None	10	None	6A	S/T*

Gravelometer Test Data: **120 Cycles per SAE J2334**

ID	20 Cycles		40 Cycles		60 Cycles	
	Rating	Level of Failure	Rating	Level of Failure	Rating	Level of Failure
11-3	10	None	10	None	10	None
11-4	10	None	10	None	10	None

  

ID	80 Cycles		100 Cycles		120 Cycles	
	Rating	Level of Failure	Rating	Level of Failure	Rating	Level of Failure
11-3	10	None	10	None	6A	S/T*
11-4	10	None	10	None	5A	S/T*

\* S/T = Substrate to Topcoat



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Gravelometer Test Data: **160 Cycles per SAE J2334**

ID	20 Cycles		40 Cycles		60 Cycles		80 Cycles	
	Rating	Level of Failure	Rating	Level of Failure	Rating	Level of Failure	Rating	Level of Failure
11-5	10	None	10	None	10	None	10	None
11-6	10	None	10	None	10	None	10	None

  

ID	100 Cycles		120 Cycles		140 Cycles		160 Cycles	
	Rating	Level of Failure	Rating	Level of Failure	Rating	Level of Failure	Rating	Level of Failure
11-5	10	None	10	None	10	None	6B	S/T*
11-6	10	None	10	None	10	None	4A	S/T*

\* S/T = Substrate to Topcoat

