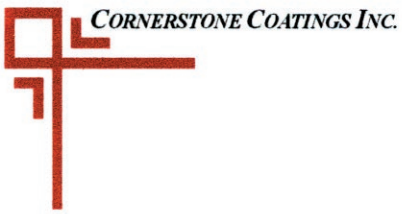

CONFIDENTIAL

TEST REPORT

EVALUATON OF DAMPERS WHEN SUBJECTED TO SALT SPRAY ASTM B117

By
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January 23, 2004

T .A. Morrison & Co. Inc.
Kevin Chapel
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RE: OBSERVATION REPORT - EVALUATION OF 5 DAMPERS WHEN EXPOSED TO 1000 HOURS OF SALT SPRAY TESTING ACCORDING TO ASTM B117

SPECIMEN NO.	IDENTIFICATION
A	Series 1500 SW -Marine Anodized Spec
B	Series 1500 SW- Standard Spec
C	Series 1500
D	Brand X Stainless Steel
E	Brand X Galvanized Steel

The samples were subjected to testing in a Singleton salt spray cabinet using ASTM B117 test methods. Although we are unable to give an actual life expectancy relative to the accelerated salt spray testing, we do feel it gives you a good relative test when compared to other competitive products. The tables below are listed in order of hours of actual time in the salt spray cabinet.

Samples that achieve complete failure are pulled from the test and will be noted as such next to their performance results.

At the bottom of each sample excessive water was being collected which interfered with the test.
One hole (5/32”) was drilled in each sample to drain water.

PROCEDURE #1 Torque Reading of Dampers

Readings were taken by closing dampers by hand until blades touched. Used torque wrench to open 90 degrees. Recorded readings in inch per pounds (in/lb).

From ninety (90) degrees open, use torque wrench to close (until blade just touch). Recorded torque readings (in/lb) for free blade movement only, not sealing or gasket compress torque.

PROCEDURE #2 Observed Samples for the following changes:

Using ASTM D610 Evaluating the degree of rusting of painted steel surfaces.
Evaluation of the Finish -Visual observation of the change of appearance.

OBSERVATION #1 December 8, 2003 **106 hours**

Procedure #1	**in/lb to open**	**in/lb to close**
SAMPLE A	0	0
SAMPLE B	0	0
SAMPLE C	0	1.25
SAMPLE D	0.50	0.50
SAMPLE E	0	0

Procedure #2	**ASTM D610**	**FINISH**
SAMPLE A	None	Surface slightly discolored with white residue, easily cleaned off with water. Note: I nut on the back side is rusting.
SAMPLE B	1 rust stain Note: Could be from drill bit filings.	Surface slightly discolored with white residue, easily cleaned off with water .
SAMPLE C	None	Surface discolored. Approximately 25% dark grey spots.
SAMPLE D	#8- see ASTM D610 chart	Rust stains coming from bracket where it attaches to fins. Rust spots throughout.
SAMPLE E	Rust spots on linkage	White residue on 90% of sample

OBSERVATION #2 December 12, .2003 **200 hours**

Procedure #1	**in/lb to open**	**in/lb to close**
SAMPLE A	0	0
SAMPLE B	0	0
SAMPLE C	0.10	1.10 Note: resistance at start (open 90 degrees) then moves easily to close position
SAMPLE D	0.55	0.90 Note: steady resistance when opening and closing of sample
SAMPLE E	0	0.05

Procedure #2	**ASTM D610**	**FINISH**
SAMPLE A	2 rust spots	Slight increase in white residue
SAMPLE B	no change	Slight increase in white residue
SAMPLE C	5 rust spots over entire sample	Slight increase in white residue. Dark spots no change.
SAMPLE D	no change	Significant rust on welds. Significant rust on nuts. Note: Least amount of white residue compared to the rest of the samples.
SAMPLE E	no change	no change

OBSERVATION #3 December 16, .2003 **300 hours**

Procedure #1	**in/lb to open**		**in/lb to close**	
	1st	2nd	1st	2nd
SAMPLE A	0	0	0	0
SAMPLE B	0	0	0	0
SAMPLE C	0	0	1.25	1.50
SAMPLE D	0.75	0.65	1.0	1.0
SAMPLE E	0	0	0	0

Procedure #2	**ASTM D610**	**FINISH**
SAMPLE A	no change	no change
SAMPLE B	no change	no change
SAMPLE C	no change	no change
SAMPLE D	no change	no change
SAMPLE E	#6	Heavier build of white residue. Rust spots on fins. Excess rust stains because of the white residue buildup. The majority of rust spots are on the lower fin. 6 nuts rusting, 4 bolts rusting.

OBSERVATION #4 December 21, .2003 **414 hours**

Procedure #1	**in/lb to open**		**in/lb to close**	
	1st	2nd	1st	2nd
SAMPLE A	0	0	0	0
SAMPLE B	0	0	0	0
SAMPLE C	0	0	1.20	1.25
SAMPLE D	1.20	1.10	1.20	1.25
SAMPLE E	0	0	0.05	0

Procedure #2	**ASTM D610**	**FINISH**
SAMPLE A	2 rust spots on front, 1 rust spot on top	no change
SAMPLE B	3 rust spots on front bottom (looks more like stains)	no change
SAMPLE C	4 rust spots on front 3 rust spots on top	Darker spots increased to 30%
SAMPLE D	no change	no change
SAMPLE E	no change	no change

OBSERVATION #5 December 29, .2003 **600 hours**

Procedure #1

	in/lb to open			in/lb to close		
	1st	2nd	3rd	1st	2nd	3rd
SAMPLE A	0	0	0	0	0	0
SAMPLE B	0	0	0	0	0	0
SAMPLE C	0.25	0.30	0.30	2.50	2.10	2.20
SAMPLE D	1.10	1.25	1.10	1.50	1.0	1.50
SAMPLE E	0	0	0	0.10	0.60	0.50

Note for Sample E: resistance when close to the closed position

Procedure #2	**ASTM D610**	**FINISH**
SAMPLE A	no change	Milky streaks over 50% of sample
SAMPLE B	no change	White residue on surface is slightly milkier
SAMPLE C	no change	Dark staining on finish 35% to 40%
SAMPLE D	no change	Rust stains from welds and where bracket attaches to fins. Most wash off with water.
SAMPLE E	#4	Rust stains are worse, because of the white film buildup it is difficult to determine which is a rust stain and which is a rust spot. Linkage has a heavy build of rust. Top piece covered by 95% rust.

OBSERVATION #6 January 8, .2004 **825 hours**

Procedure #1

	in/lb to open			in/lb to close		
	1st	2nd	3rd	1st	2nd	3rd
SAMPLE A	0	0	0	0	0	0
SAMPLE B	0	0	0	0	0	0
SAMPLE C	0.35	0.35	0.30	2.50	2.60	2.25
SAMPLE D	1.70	1.55	1.50	2.50	2.10	2.10
SAMPLE E	0.04	0	0.02	1.10	0.20	1.00

Procedure #2	**ASTM D610**	**FINISH**
SAMPLE A	no change	Some dark white spots on surface, looks like heavy build up of salt. Cleans off easily, but leaves a stain
SAMPLE B	no change	Some dark white spots on surface, looks like heavy build up of salt. Cleans off easily but leaves a stain
SAMPLE C	no change	no change
SAMPLE D	no change	Some white spots on surface, looks like heavy build up of salt.
SAMPLE E	#3	Rust stains are worse, because of the white film buildup it is difficult to determine which is a rust stain and which is a rust spot. Linkage has a heavy build of rust, approximately 75% covered by rust

OBSERVATION #7 January 15, .2004 **1000 hours**

Procedure #1	**in/lb to open**			**in/Ib to close**		
	1st	2nd	3rd	1st	2nd	3rd
SAMPLE A	0	0	0	0	0	0
SAMPLE B	0	0	0	0	0	0
SAMPLE C	0.75	1.20	1.00	3.00	2.60	3.00
SAMPLE D	1.85	2.50	2.15	1.50	1.70	1.40
SAMPLE E	0.50	0	0	1.50	0.40	0.75

Note: sample D when opening and closing sample has a screeching sound

Procedure #2	**ASTM D610**	**FINISH**
SAMPLE A	no change	no change
SAMPLE B	no change	no change
SAMPLE C	no change	40 to 50% dark spots
SAMPLE D	no change	no change
SAMPLE E	#2	Rust stains are worse. Linkage has a heavy build of approximately 95% covered by rust

CONCLUSION

After testing the samples A, B, C, D and E for 1000 hours using Test ASTM B117 the following observations are noted.

Results of Procedure #1
In order of best to worst results as follows:

To Open	To Close
# 1 Sample B	# 1 Sample B
#2 Sample A	#2 Sample A
#3 Sample E	#3 Sample E
#4 Sample C	#4 Sample D
#5 Sample D	#5 Sample C

In my opinion sample B outperformed Sample A for the following reason: After opening or closing the fins with the torque wrench on Sample B, when ratcheting the wrench back to see what the reading was the fins would also move, not allowing the wrench to ratchet back (no resistance). On every other sample the fins would not move in this manner.
This is the only difference between Sample A and Sample B.

Sample E: resistance occurred at the start when opening the fins, after this initial resistance, movement was smooth and easy.

Sample C: resistance occurred at the start when closing the fins. After this initial resistance, movement was smooth and easy.

Sample C: resistance occurred at the end of opening the fins, before this end resistance, movement was smooth and easy.

Sample D: there was continual and consistent resistance from start to end, for both closing and opening. At 1000 hour observation, when opening and closing the fins, there was a screeching sound.

Note: On closing Sample D over each observation, there was consistent increases in resistance. From Observation 6 to Observation 7 there was a decrease in resistance. I would have to continue to test past 1000 hours to see if this was human error in operating the torque wrench. In my opinion even with this irregularity, Sample D still performed poorly .

Results of Procedure #2

Rust spots that showed up on samples A, B, and C did not grow in size and from initial occurrence to the end of the test. It is in my opinion that the rust came from an external contaminant and not from the samples themselves. Therefore these rust spots should not be considered in the overall performance and results of this test.

In order of best to worst results as follows:

ASTM p610 Rusted Areas	Finish
#1 Sample A	#1 Samples A, B, and D are close.
#2 Sample B	#2 Samples C
#3 Sample C	#3 Sample E
#4 Sample D	
#5 Sample E	

After considering the results of Procedure #1 and Procedure #2, it is in my opinion that Sample B, closely followed by Sample A, gave the best results after 1000 hours of Salt Spray testing.

I hope the results of these tests meet with your approval. If you have any questions, or require any clarification regarding these test results, please do not hesitate to contact me.

Yours sincerely,

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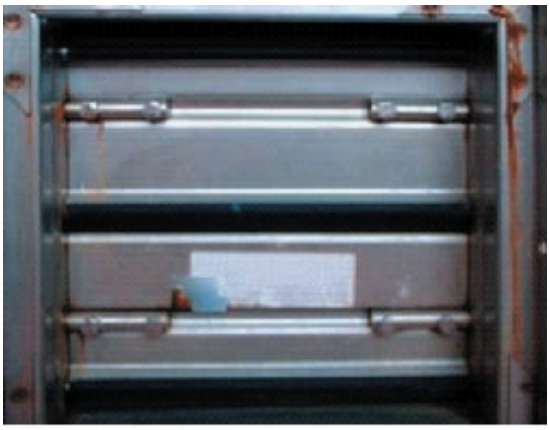
(306) 369-2521

Observation #7 / 1000 hours
Front View

TAMCO 1500 SW

Stainless Steel



Galvanized Steel

Back View

TAMCO 1500 SW

Stainless Steel

Galvanized Steel

Linkage

TAMCO 1500 SW

Stainless Steel

Galvanized Steel