Sample: Galvanized steel plate coated with Trenchcoat polymer

Report No.: 09-020-04-014

SUBJECT: Corrosion and abrasion tests on galvanized steel plate coated with Trenchcoat polymer

- corrosion tests with conventional salt spray in accordance with standard ASTM B117;
- abrasion tests with automated humid sandblast.

SAMPLES DESCRIPTION:

1. Galvanized steel plate coated with Trenchcoat.
2. Galvanized steel plate coated with Trenchcoat, including a welded joint covered with primer.
3. Galvanized steel plate coated with Trenchcoat, including a X-groove to the plain steel.
4. Aluminized steel plate.
5. Galvanized steel plate.

SALT SPRAY TESTS:

Work Procedure:

Five steel plates have been placed in a salt spray cabinet during 4,000 hours. They were removed at regular intervals, rinsed and cleaned with a soft brush. Pictures were taken at all breakpoints.

See Appendix A.

Observations were made at the following exposure steps:

- Before testing
- 250, 1000, 1700, 2200, 2700, 3000, 3500, 4000 hours

See Table 1.

Results:

1. **Galvanized steel plate coated with Trenchcoat.**

   Loss of thickness almost null and no polymer coat delaminating after 4000 hours of exposure.

2. **Galvanized steel plate coated with Trenchcoat, including a welded joint covered with repair paint.**

   The repair paint on the welded joint didn't produce the expected results. The paint deteriorated after 1700 hours of exposure, leaving the door open to corrosion under the surface of the adjacent coating.
   Consequently, we must avoid welded joints in a galvanized steel pipe used as a culvert.

3. **Galvanized steel plate coated with Trenchcoat, including a X-groove to the plain steel.**

   After 2200 hours, the salt started to filter under the polymer surface, causing its gradual delaminating until about 60% of the plate surface at 4000 hours of exposure.

   In case of deterioration of the polymer during fabrication, handling or transportation, the repair method must be as sustainable as the polymer itself.

ABRASION TESTS:

Work Procedure:

Four steel plates were subjected to the abrasion test during four cycles. Pictures were taken at all breakpoints.
See Appendix B.

Test parameters:

- 340 g/minute of abrasive, i.e. silica sand C-109 from Ottawa, Illinois, in accordance with standard ASTM C-778;
- pressure: 1200 kPa;
- duration: 51,5 min/cycle;
- effective area of the steel plates: 130 cm^2.

The steel plates were removed at the end each cycle, cleaned and their picture taken to measure the grade of abrasion.

Observations were made at the following cycles:

- Before testing
- Cycles 1, 2, 3 and 4

See Table 2.

Results:

1. **Galvanized steel plate coated with Trenchcoat;**

   Slight loss of thickness and no polymer coat delaminating at the surface after four abrasion cycles.

2. **Galvanized steel plate coated with Trenchcoat, including a welded joint covered with repair paint.**

   The welded joint's repair didn't produce the expected results. The paint used for the repair disappeared at the first abrasion cycle. However, the Trenchcoat product didn't deteriorate during the other cycles. In case of deterioration of the polymer during fabrication, handling or transportation, the repair method must be as sustainable as the polymer itself.

Addressee:

c.o.:

Prepared by: Gaétan Rousseau, performance testing technician

Verified by: Donald Villeneuve, P.Eng.

Date: 2007-02-16

SALT SPRAY TESTING (results summary) Table 1

Report No.: 04-014 Testing Start Date: 2006-07-04 Testing End Date: 2006-12-27

Sample	250 hours	500 hours	1000 hours	1700 hours	2200 hours	2710 hours	3000 hours	3500 hours	4000 hours
Steel Trenchcoat # 1									No deterioration
Welded Joint covered with paint # 2				Peeling of paint	Peeling of paint	Peeling of paint and initial lifting of Trenchcoat	Peeling of paint and lifting of Trenchcoat	Peeling of paint and lifting of Trenchcoat	Complete peeling of paint and 60% lifting of Trenchcoat
Trenchcoat (grooved) # 3					Initial lifting of Trenchcoat at the points	Lifting of Trenchcoat	Lifting of Trenchcoat	Lifting of Trenchcoat	60% lifting of Trenchcoat
Aluminized Steel # 4				Initial corrosion	5% Corrosion	10% Corrosion	15% Corrosion	20% Corrosion	25% Corrosion
Galvanized Steel # 5			50% Corrosion	60% Corrosion	65% Corrosion	80% Corrosion	85% Corrosion	90% Corrosion	100% Corrosion

2007-02-15 Table 1 Final Results Summary

TABLE 2 – ABRASION TEST WITH HUMID SANDBLAST

MATÉRIAL			CUMULATIVE LOSSES			
Type	Weight (g) / Thickness (µm)	Weight loss (g) / Computed Thickness Loss (µm)	CYCLE			
			1st cycle	2nd cycle	3rd cycle	4th cycle
Galvanized Steel	424.12 / 41	Weight loss (g)	0.89	2.18	3.58	4.68
		Thickness Loss (µm)	10	24	39	Total loss of zinc
Aluminized Steel	420.83 / 48	Weight loss (g)	0.73	1.57	2.48	
		Thickness Loss (µm)	21	45	Total loss of aluminum	
Steel + "Trenchcoat"	201.27 / 300	Weight loss (g)	0.11	0.29	0.48	0.69
		Thickness Loss (µm)	10	23	39	56
Steel + Repair Paint on Joint	353.06 / 250	Weight loss (g)	0.60			
		Thickness Loss (µm)	Total loss of paint			

Thickness is measured before testing with an Elcometer 456 standard device and computed for cycles 1, 2, 3 and 4.
Estimated density: Zinc (7.14 g/cm³), Aluminum (2.70 g/cm³), Trenchcoat (0.95 g/cm³)
Computation examples:
7.14 g = 1cm³ thus a weight loss of 3.58 g = (3.58 gr/7.14g/cm³) = 0.50210 cm³ volume for a 130 cm² estimated area. Zinc thickness = 0.50210 cm³/130 cm² = 0.00386 cm = 0.038 mm = 38.6 µm
Testing parameters: 340 g/min of abrasive (silica sand C-109 form Ottawa, Illinois, in accordance with standard ASTM C-778 Table 1) Graded sand
Pressure: 1,200 kpa 51,5 min/cycle, Plates estimated area: 130 cm².

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Trenchcoat

File Lab. 09-020-04-014

Salt spray testing (pictures)
APENDIX A

January 26, 2007

By: Gaétan Rousseau, Tech.

Plate #1
Trenchcoat

Plate #2
Trenchcoat
Welded Joint

Plate #3
Trenchcoat
X Groove

Before Testing

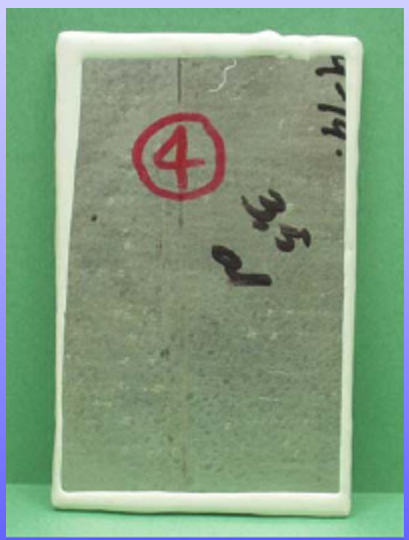

Plate #4
Aluminized Steel

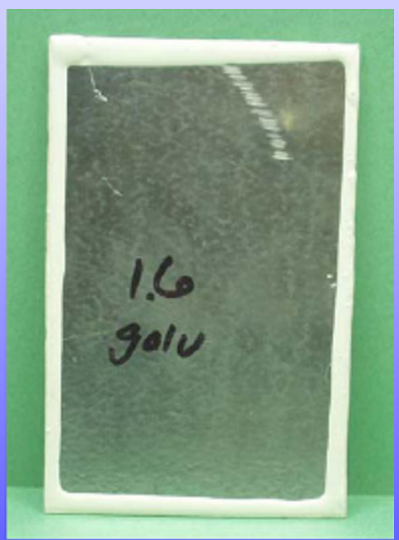

Plate #5
Galvanized Steel

Plate #1
Trenchcoat

Plate #2
Trenchcoat
Welded Joint

Plate #3
Trenchcoat
X Groove

250 hours

Plate #4
Aluminized Steel

Plate #5
Galvanized Steel

Plate #1
Trenchcoat

Plate #2
Trenchcoat
Welded Joint

Plate #3
Trenchcoat
X Groove

500 hours

Plate #4
Aluminized Steel

Plate #5
Galvanized Steel

Plate #1
Trenchcoat

Plate #2
Trenchcoat
Welded Joint

Plate #3
Trenchcoat
X Groove

1000 hours

Plate #4
Aluminized Steel

Plate #5
Galvanized Steel

Plate #1
Trenchcoat

Plate #2
Trenchcoat
Welded Joint

Plate #3
Trenchcoat
X Groove

1700 hours

Plate #4
Aluminized Steel

Plate #5
Galvanized Steel

Plate #1
Trenchcoat

Plate #2
Trenchcoat
Welded Joint

Plate #3
Trenchcoat
X Groove

2200 hours

Plate #4
Aluminized Steel

Plate #5
Galvanized Steel

Plate #1
Trenchcoat

Plate #2
Trenchcoat
Welded Joint

Plate #3
Trenchcoat
X Groove

2710 hours

Plate #4
Aluminized Steel

Plate #5
Galvanized Steel

Plate #1
Trenchcoat

Plate #2
Trenchcoat
Welded Joint

Plate #3
Trenchcoat
X Groove

3000 hours

Plate #4
Aluminized Steel

Plate #5
Galvanized Steel

Plate #1
Trenchcoat

Plate #2
Trenchcoat
Welded Joint

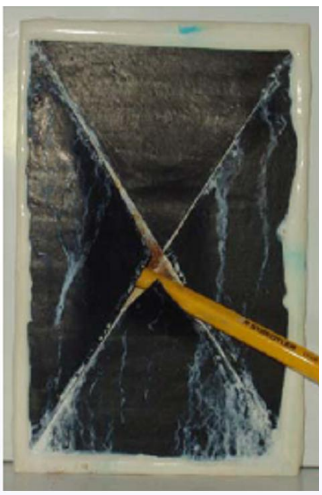

Plate #3
Trenchcoat
X Groove

3500 hours

Plate #4
Aluminized Steel

Plate #5
Galvanized Steel

Plate #1
Trenchcoat

Plate #2
Trenchcoat
Welded Joint

Plate #3
Trenchcoat
X Groove

4000 hours

Plate #4
Aluminized Steel

Plate #5
Galvanized Steel

Plate #1
Trenchcoat

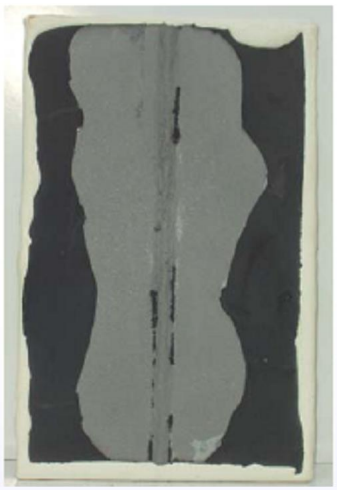

Plate #2
Trenchcoat
Welded Joint

Plate #3
Trenchcoat
X Groove

After Cleaning

Plate #4
Aluminized Steel

Plate #5
Galvanized Steel

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Trenchcoat coating for corrugated steel pipes

File Lab. 09-020-04-014

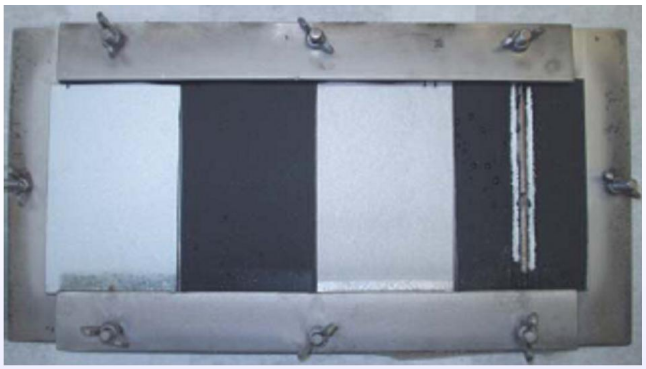
APPENDIX B

AbrasionTesting (pictures)

January 29, 2007

By: Gaétan Rousseau Tech.

Before Testing



Cycle 1

Cycle 2

Cycle 3

Cycle 4