

## Final Report

on

## Laboratory Testing of Jotun Fusion Bond Epoxy Products

Prepared by Gary Cox

Report No. 00-1120  
I.T.I. Contract No. 6425

May 12, 2000

I.T.I. Anti-Corrosion, Inc.  
10175 Harwin \* Suite 110  
Houston, Texas 77036  
Telephone: (713) 771-0688  
Facsimile (713) 776-9634

**Coating Material I.D. Jotun EP-F 1010 Batch No. 2 Color Grey**

Manufacturing Location: Flixborough, England Plant

## Test Results

### 1. Thermal Characteristics

1.1 Test Instrument: DuPont Instruments Model 910 Differential Scanning Calorimeter

Tg 1: 61.53°C; Tg 2: 99.73°C; Tg 3:105.08°C; Tg 4:105.02°C;  $\Delta T_g$ : 0.06°C

$\Delta H$ : 55.32 J/g;  $\Delta H_1$ : 0.6481 J/g; % Conversion: 98.8

### 2. Short Term Cathodic Disbondment Tests

Specimen No.	Test Temp.	Test Duration	Test Potential	Disbonded radius, mm	Acceptance Criterion	Pass/Fail
1	65°C	24 hrs.	-3.50 VDC	3.48	8 mm Maximum	Pass
2	65°C	24 hrs.	-3.50 VDC	3.73	8 mm Maximum	Pass
3	65°C	24 hrs.	-3.50 VDC	3.38	8 mm Maximum	Pass
Average				3.53		Pass
4	65°C	48 hrs.	-1.50 VDC	3.14	8 mm Maximum	Pass
5	65°C	48 hrs.	-1.50 VDC	3.60	8 mm Maximum	Pass
6	65°C	48 hrs.	-1.50 VDC	3.27	8 mm Maximum	Pass
Average				3.34		Pass

### 3. Long Term Cathodic Disbondment Tests

Specimen No.	Test Temp.	Test Duration	Test Potential	Disbonded radius, mm	Acceptance Criterion	Pass/Fail
1	23°C	28 days	-1.50 VDC	5.75	10 mm Maximum	Pass
2	23°C	28 days	-1.50 VDC	5.25	10 mm Maximum	Pass
3	23°C	28 days	-1.50 VDC 1	4.88	10 mm Maximum	Pass
Average				5.29		Pass

**Coating Material I.D. Jotun EP-F 1010 Batch No. 2 Color Grey**

Manufacturing Location: Flixborough, England Plant

## 4. Chemical Resistance (90 Day immersion at 23°C)

Immersion Reagent	Specimen No.	Evaluation Parameter						
		Bleaching	Swelling	Softening	Blisters	Cracks	Delamination	Loss of Adhesion
HCl in distilled H <sub>2</sub> O pH 2.5–3.0	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
10% NaCl w/H <sub>2</sub> SO <sub>4</sub> in distilled H <sub>2</sub> O pH 2.5–3.0	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
10% NaCl in distilled H <sub>2</sub> O	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
Distilled H <sub>2</sub> O	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
5% NaOH in distilled H <sub>2</sub> O	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
MgCO <sub>3</sub> : CaCO <sub>3</sub> 1:1 in distilled H <sub>2</sub> O Sat'd Sol'n.	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0

**Coating Material I.D.**    **Jotun EP-F 1010**    **Batch No. 2**    **Color Grey**

Manufacturing Location: Flixborough, England Plant

## 5 & 6. Porosity Ratings

	Rating	Acceptance Criterion	Pass/Fail
5. Cross-Section:	1	1–4	Pass
6. Interface:	1	1–4	Pass

## 7. 3° Flexibility at -30°C

Specimen No.	Cracking		Acceptance Criterion	Pass/Fail
	Immediate	After 2 hrs @ 23°C		
1	0	0	No Cracking	Pass
2	0	0	No Cracking	Pass
3	0	0	No Cracking	Pass
4	0	0	No Cracking	Pass
5	0	0	No Cracking	Pass

Note: Two straps were intentionally overbent to: 4.78°/p.d. No cracking was observed on any specimen, either immediately or after 2 hours.

## 8. 1.5J Impact Resistance at -30°C

Specimen No.	Impact No.	Impact Force J	Acceptance Criterion	Pass/Fail
1	1	1.5	No Holidays at ≤ 1.5J	Pass
	2	1.5	No Holidays at ≤ 1.5J	Pass
	3	1.5	No Holidays at ≤ 1.5J	Pass
2	1	3.1	No Holidays at ≤ 1.5J	Pass
	2	3.1	No Holidays at ≤ 1.5J	Pass
	3	3.1	No Holidays at ≤ 1.5J	Pass

**Coating Material I.D.**    **Jotun EP-F 1010**    **Batch No. 2**    **Color Grey**

Manufacturing Location: Flixborough, England Plant

## 9. Strained Coating, 28 day Cathodic Disbondment

Specimen No.	Cracking	Acceptance Criterion	Pass/Fail
1	0	No Cracking	Pass
2	0	No Cracking	Pass
3	0	No Cracking	Pass

## 10. 24 or 48 hour adhesion (Hot Water Immersion)

Specimen No.	Test Duration	Test Temperature	Adhesion Rating	Acceptance Criterion	Pass/Fail
1	24 hours	95°C	1	1-3	Pass
2	24 hours	95°C	1	1-3	Pass
3	24 hours	95°C	1	1-3	Pass
4	48 hours	75°C	1	1-3	Pass
5	48 hours	75°C	1	1-3	Pass
6	48 hours	75°C	1	1-3	Pass

**Coating Material I.D.    Jotun EP-F 1003 HW    Batch No. 2    Color Blue**

Manufacturing Location: Flixborough, England Plant

## Test Results

### 1. Thermal Characteristics

1.1 Test Instrument: DuPont Instruments Model 910 Differential Scanning Calorimeter

T<sub>g</sub> 1: 63.37°C; T<sub>g</sub> 2: 100.29°C; T<sub>g</sub> 3: 101.30°C; T<sub>g</sub> 4: 103.40°C; ΔT<sub>g</sub>: 2.10°C

ΔH: 58.27 J/g; ΔH<sub>1</sub>: 1.655 J/g; % Conversion: 97.16

### 2. Short Term Cathodic Disbondment Tests

Specimen No.	Test Temperature	Test Duration	Test Potential	Disbonded Radius mm	Acceptance Criterion	Pass/Fail
1	65°C	24hrs	-3.50 VDC	2.45	8mm Maximum	Pass
2	65°C	24hrs	-3.50 VDC	2.44	8mm Maximum	Pass
3	65°C	24hrs	-3.50 VDC	2.54	8mm Maximum	Pass
Average				2.48		Pass
4	65°C	48hrs	-1.50 VDC	4.24	8mm Maximum	Pass
5	65°C	48hrs	-1.50 VDC	4.29	8mm Maximum	Pass
6	65°C	48hrs	-1.50 VDC	4.75	8mm Maximum	Pass
Average				4.43		Pass

### 3. Long Term Cathodic Disbondment Tests

Specimen No.	Test Temperature	Test Duration	Test Potential	Disbonded Radius mm	Acceptance Criterion	Pass/Fail
1	23°C	28 days	-1.50 VDC	8.25	10mm Maximum	Pass
2	23°C	28 days	-1.50 VDC	8.25	10mm Maximum	Pass
3	23°C	28 days	-1.50 VDC	7.75	10mm Maximum	Pass
Average				8.08		Pass

**Coating Material I.D. Jotun EP-F 1003 HW Batch No. 2 Color Blue**

Manufacturing Location: Flixborough, England Plant

#### 4. Chemical Resistance (90 Day immersion at 23°C)

Immersion Reagent	Specimen No.	Evaluation Parameter						
		Bleaching	Swelling	Softening	Blisters	Cracks	Delamination	Loss of Adhesion
HCl in distilled H <sub>2</sub> O pH 2.5–3.0	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
10% NaCl w/H <sub>2</sub> SO <sub>4</sub> in distilled H <sub>2</sub> O pH 2.5–3.0	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
10% NaCl in distilled H <sub>2</sub> O	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
Distilled H <sub>2</sub> O	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
5% NaOH in distilled H <sub>2</sub> O	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
MgCO <sub>3</sub> : CaCO <sub>3</sub> 1:1 in distilled H <sub>2</sub> O Sat'd Sol'n.	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0

**Coating Material I.D. Jotun EP-F 1003 HW Batch No. 2 Color Blue**

Manufacturing Location: Flixborough, England Plant

## 5 & 6. Porosity Ratings

	Rating	Acceptance Criterion	Pass/Fail
5. Cross-Section:	1	1–4	Pass
6. Interface:	2	1–4	Pass

## 7. 3° Flexibility at -30°C

Specimen No.	Cracking		Acceptance Criterion	Pass/Fail
	Immediate	After 2 hrs @ 23°C		
1	0	0	No Cracking	Pass
2	0	0	No Cracking	Pass
3	0	0	No Cracking	Pass
4	0	0	No Cracking	Pass
5	0	0	No Cracking	Pass

Note: Two straps were intentionally overbent to: 4.23°/p.d. No cracking was observed on any specimen, either immediately or after 2 hours.

## 8. 1.5J Impact Resistance at -30°C

Specimen No.	Impact No.	Impact Force J	Acceptance Criterion	Pass/Fail
1	1	1.5	No Holidays at ≤ 1.5J	Pass
	2	1.5	No Holidays at ≤ 1.5J	Pass
	3	1.5	No Holidays at ≤ 1.5J	Pass
2	1	3.1	No Holidays at ≤ 1.5J	Pass
	2	3.1	No Holidays at ≤ 1.5J	Pass
	3	3.1	No Holidays at ≤ 1.5J	Pass

**Coating Material I.D.    Jotun EP-F 1003 HW    Batch No. 2    Color Blue**

Manufacturing Location: Flixborough, England Plant

## 9. Strained Coating, 28 day Cathodic Disbondment

Specimen No.	Cracking	Acceptance Criterion	Pass/Fail
1	0	No Cracking	Pass
2	0	No Cracking	Pass
3	0	No Cracking	Pass

## 10. 24 or 48 hour adhesion (Hot Water Immersion)

Specimen No.	Test Duration	Test Temperature	Adhesion Rating	Acceptance Criterion	Pass/Fail
1	24 hours	95°C	2	1-3	Pass
2	24 hours	95°C	1	1-3	Pass
3	24 hours	95°C	2	1-3	Pass
4	48 hours	75°C	1	1-3	Pass
5	48 hours	75°C	1	1-3	Pass
6	48 hours	75°C	1	1-3	Pass

**Coating Material I.D.    Jotun EP-F 1003 LD    Batch No. 355    Color Beige**

Manufacturing Location: Flixborough, England Plant

## Test Results

### 1. Thermal Characteristics

1.1 Test Instrument: DuPont Instruments Model 910 Differential Scanning Calorimeter

T<sub>g</sub> 1: 64.18°C; T<sub>g</sub> 2: 100.04°C; T<sub>g</sub> 3: 103.19°C; T<sub>g</sub> 4: 103.91°C; ΔT<sub>g</sub>: 0.72°C

ΔH: 58.51 J/g; ΔH<sub>1</sub>: 1.254 J/g; % Conversion: 97.9

### 2. Short Term Cathodic Disbondment Tests

Specimen No.	Test Temperature	Test Duration	Test Potential	Disbonded Radius mm	Acceptance Criterion	Pass/Fail
1	65°C	24hrs	-3.50 VDC	2.74	8mm Maximum	Pass
2	65°C	24hrs	-3.50 VDC	2.56	8mm Maximum	Pass
3	65°C	24hrs	-3.50 VDC	2.30	8mm Maximum	Pass
Average				2.53		Pass
4	65°C	48hrs	-1.50 VDC	3.16	8mm Maximum	Pass
5	65°C	48hrs	-1.50 VDC	3.60	8mm Maximum	Pass
6	65°C	48hrs	-1.50 VDC	3.03	8mm Maximum	Pass
Average				3.26		Pass

### 3. Long Term Cathodic Disbondment Tests

Specimen No.	Test Temperature	Test Duration	Test Potential	Disbonded Radius mm	Acceptance Criterion	Pass/Fail
1	23°C	28 days	-1.50 VDC	5.50	10mm Maximum	Pass
2	23°C	28 days	-1.50 VDC	5.25	10mm Maximum	Pass
3	23°C	28 days	-1.50 VDC	4.75	10mm Maximum	Pass
Average				5.17		Pass

**Coating Material I.D. Jotun EP-F 1003 LD Batch No. 355 Color Beige**

Manufacturing Location: Flixborough, England Plant

#### 4. Chemical Resistance (90 Day immersion at 23°C)

Immersion Reagent	Specimen No.	Evaluation Parameter						
		Bleaching	Swelling	Softening	Blisters	Cracks	Delamination	Loss of Adhesion
HCl in distilled H <sub>2</sub> O pH 2.5–3.0	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
10% NaCl w/H <sub>2</sub> SO <sub>4</sub> in distilled H <sub>2</sub> O pH 2.5–3.0	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
10% NaCl in distilled H <sub>2</sub> O	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
Distilled H <sub>2</sub> O	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
5% NaOH in distilled H <sub>2</sub> O	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0
MgCO <sub>3</sub> : CaCO <sub>3</sub> 1:1 in distilled H <sub>2</sub> O Sat'd Sol'n.	1	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0

**Coating Material I.D. Jotun EP-F 1003 LD Batch No. 355 Color Beige**

Manufacturing Location: Flixborough, England Plant

## 5 & 6. Porosity Ratings

	Rating	Acceptance Criterion	Pass/Fail
5. Cross-Section:	1	1–4	Pass
6. Interface:	2	1–4	Pass

## 7. 3° Flexibility at -30°C

Specimen No.	Cracking		Acceptance Criterion	Pass/Fail
	Immediate	After 2 hrs @ 23°C		
1	0	0	No Cracking	Pass
2	0	0	No Cracking	Pass
3	0	0	No Cracking	Pass
4	0	0	No Cracking	Pass
5	0	0	No Cracking	Pass

Note: Two straps were intentionally overbent to: 4.19°/p.d. No cracking was observed on any specimen, either immediately or after 2 hours.

## 8. 1.5J Impact Resistance at -30°C

Specimen No.	Impact No.	Impact Force J	Acceptance Criterion	Pass/Fail
1	1	1.5	No Holidays at ≤ 1.5J	Pass
	2	1.5	No Holidays at ≤ 1.5J	Pass
	3	1.5	No Holidays at ≤ 1.5J	Pass
2	1	3.1	No Holidays at ≤ 1.5J	Pass
	2	3.1	No Holidays at ≤ 1.5J	Pass
	3	3.1	No Holidays at ≤ 1.5J	Pass

**Coating Material I.D. Jotun EP-F 1003 LD Batch No. 355 Color Beige**

Manufacturing Location: Flixborough, England Plant

## 9. Strained Coating, 28 day Cathodic Disbondment

Specimen No.	Cracking	Acceptance Criterion	Pass/Fail
1	0	No Cracking	Pass
2	0	No Cracking	Pass
3	0	No Cracking	Pass

## 10. 24 or 48 hour adhesion (Hot Water Immersion)

Specimen No.	Test Duration	Test Temperature	Adhesion Rating	Acceptance Criterion	Pass/Fail
1	24 hours	95°C	2	1-3	Pass
2	24 hours	95°C	2	1-3	Pass
3	24 hours	95°C	2	1-3	Pass
4	48 hours	75°C	2	1-3	Pass
5	48 hours	75°C	2	1-3	Pass
6	48 hours	75°C	3	1-3	Pass

## TESTING EQUIPMENT & QUALITY CONTROL INSTRUMENT SOURCES

The following list identifies sources of testing equipment for Quality Control/Assurance Laboratories plus independent test labs:

- 1. Paul N. Gardner Company Inc.** (Coating test instruments, etc.)  
316 NE, 1st.  
Pompano Beach, Florida  
U.S.A. 33060  
Telephone: 1-305-946-9454  
Fax: 1-305-946-9309
- 2. Testing Machines Inc.** (Testing Machines)  
400 Bayview Avenue  
Amityville, New York  
U.S.A. 11701  
Telephone: 516-842-5400
- 3. Tinuis Olsen Testing Machine Co. Inc.** (Testing Machines)  
Easton Road, Box 429,  
Willow Grove, PA  
U.S.A. 19090-0429  
Telephone: 1-215-675-7100  
Fax: 1-216-441-0899
- 4. Instron Corporation** (Tensile Testing Machines)  
100 Royal Street  
Canton, Mass.  
U.S.A. 02021-1089  
Telephone: 1-617-828-2500  
Fax: 1-617-575-5725
- 5. Erichsen Instruments Inc.** (USA Distributor)  
TJ. Bell Inc.  
1340 Home Ave.  
Akron, Ohio  
U.S.A. 44310  
Telephone: 1-216-663-36M  
Fax: 1-216-633-1977
- 6. S.G. Pinney & Assoc. Inc.** (Coating Test Instruments)  
P.O. Box 9220  
Port St. Lucie, Florida  
U.S.A. 3498519220  
Telephone: 1-407-337-3080  
Fax: 1-407-337-0294
- 7. K-TA-TATOR, Inc.** (Coating Instruments for testing & measurement)  
115 Technology Drive  
Pittsburgh, PA  
U.S.A. 15275  
Telephone: 1412-788-1300  
Fax: 1-412.788-1306

8. Ontario Die Company Ltd.  
(ODC International Inc.)  
119 Roger Street, P.O. Box 70  
Waterloo, Ontario  
Canada, NU 3Z6  
(Die Stamping Forms)  
Telephone: 1-519-576-8950  
Fax: 1-519-576-3670
9. TA Instruments Inc.  
Box 311, 10 Lukens Drive  
New Castle, Delaware  
U.S.A. 19720-0311  
(Thermal Analyzers)  
Telephone: 1-302-427-4000  
Fax: 1-302-4274001
10. SSPC  
Steel Structures Painting Council  
4400 Fifth Avenue  
Pittsburgh, PA  
U.S.A. 15213-2683  
(Surface Prep. Specifications)
11. ASTM  
100 Barr Harbour Drive  
West Conshocken, PA  
U.S.A. 19428-2959  
(Testing Standards)  
Telephone: 1-610-832-9585  
Fax: 1-610-832-9555
12. I.T.I Anti-Corrosion, Inc.  
10175 Harwin, #110  
Houston, Texas  
U.S.A. 77036  
(Independent Test Laboratory)  
Telephone: 1-713-771-0688  
Fax: 1-713-776-9634
13. Harding & Neal  
10 Wild Oak Circle  
Houston, Texas  
U.S.A. 77055-4724  
(Q.C.1QA Laboratory Consultants)  
Telephone: 1-713~8405  
Fax: 1-716-464-4532
14. Ceast U.S.A. Inc.  
Box 30785  
Fort Mill, SC  
U.S.A. 29715  
(Testing Instruments for plastics)  
(European based company)  
Telephone: 1-803-548-6093  
Fax: 1-803-548-1954
15. Atlas Electric Devices Company  
4114 North Ravenswood Ave.,  
Chicago, Illinois  
U.S.A. 60613  
(Weather-o-meter Testing)  
Telephone: 1-312-327453  
Fax: 1-312-327-5787

16. Bodycote Materials Testing Ltd.  
North West Laboratory  
Jefferson House  
5 Washington Centre  
Broadway  
Salford M5 2UW  
UK

Telephone: +44 (0) 161 876 0277

17. Mettler Toledo GmbH  
CH-8606 Greifensee  
Switzerland

Telephone: (01) 944 22 11  
[www.mt.com](http://www.mt.com)

**Technical Report No. 99-1042**

**Mr. Denis Grimshaw  
JOTUN POWDER COATINGS, LTD.  
2nd Avenue  
Flixborough Industrial Estate  
Scunthorpe DN15 8SD**

## **Laboratory Testing of Corro-Coat EP-F 1010**

**October 12, 1999**

**Prepared by Gary Cox**

**I.T. I. Contract No. 6193**

## LABORATORY TESTING OF 'CORRO-COAT EP-F 1010'

### Introduction:

As authorized by Mr. Denis Grimshaw of Jotun Powder Coatings, Ltd., I.T.I. AntiCorrosion, Inc., has conducted laboratory testing to evaluate performance characteristics of "Corro-Coat EP-F 1010".

### Test Procedures

1. Cathodic Disbondment in accordance with CAN/CSA Z245.20-M98 with modifications as indicated below.

- 1.1 Duration: 28 days      Temperature: 20°C      Modification: None
- 1.2 Duration: 28 days      Temperature: 65°C      Modification: 28 day
- 1.3 Duration: 28 days      Temperature: 80°C      Modification: 28days; 80°C
- 1.4 Duration: 48 hours      Temperature: 65°C      Modification: None

Note: All above procedures were conducted at -1.50 VDC potential in a 3% weight percent sodium chloride electrolyte.

2. Adhesion (hot water soak) in accordance with CAN/CSA Z245.20-M98 with modifications as indicated below.
  - 2.1 Duration: 28 days      Temperature: 65°C      Modification: 28 days
  - 2.2 Duration: 28 days      Temperature: 80°C      Modification: 28 days; 80°C
3. Impact Resistance in accordance with CAN/CSA Z245.20-98 at six (6) temperatures: -30°C, 0°C, 20°C, 65°C and 75°C.
4. Flexibility in accordance with CAN /CSA Z245.20-98 at six (6) temperatures: -30°C, -10°C, 0°C, 20°C, 65°C and 75°C.
5. Hardness, Shore "D", in accordance with ASTM D2240 at six (6) temperatures: -30°C, -10°C, 0°C, 20°C, 65°C and 75°C.
6. Abrasion resistance in accordance with ASTM D4060
  - 6.1 Wheels: CS-17 Load: 1kg      Cycles: 1000
  - 6.2 Wheels: CS-17 Load: 1kg      Cycles: 5000

7. Electrochemical Impedance Spectroscopy (EIS).

Electrolyte: 0,01 M Na<sub>2</sub> SO<sub>4</sub>

Immersion Electrolyte Temperature: 65°C±2°C

E I S Measurements intervals: 0, 1, 4,7,14,21 and 28 days.

8. Gouge Test (a modification of ASTM D2197 using a balance beam scrape adhesion tester).

Modifications: 1. Phillips Head Screw driver point for stylus.

2. Loads: 25, 30, 35, 40, 45 and 50 Kg (55, 66, 77, 88, 99 and 110 lbs.)

## Test Results

### 1. Cathodic Disbondment

Test Conditions			Disbonded radius, mm			
Duration, Days/hours	Test Temperature °C	Potential VDC	Specimen No 1	Specimen No 2	Specimen No 3	Average
48 hours	65	-1.50	3.5	1.9	1.9	2.3
28 days	20	-1.50	5.9	4.8	4.6	5.1
28 days	65	-1.50	7.0	7.7	6.6	7.1
28 days	80	-1.50	6.4	6.9	6.4	6.6

### 2. Adhesion, (Hot water soak)

Test Conditions		Adhesion Ratings			
Duration	Temperature	No 1	No 2	No 3	Average
28 days	65°C	1	1	1	1
28 days	80°C	2	2	2	2

#### Adhesion Ratings:

Rating 1: Coating cannot be removed cleanly.

Rating 2: Less than 50% of the coating can be removed.

Rating 3: More than 50% of the coating can be removed, but the coating demonstrates a definite resistance to the levering action.

Rating 4: The coating can be easily removed in strips or large chips.

Rating 5: The coating can be completely removed as a single piece.

### 3. Impact Resistance

Specimen No	DFT mils	Temp °C	Impacts at 1.50 Joules (13.28 in-lbs), Pass/Fail		
			No 1	No 2	No 3
1	21	-30	Pass	Pass	Pass
2	20	-10	Pass	Pass	Pass
3	19	0	Pass	Pass	Pass
4	21	20	Pass	Pass	Pass
5	19	65	Pass	Pass	Pass
6	19	75	Pass	Pass	Pass

### 4. Flexibility

Specimen No	Test Temp °C	Angle of Deflection	Cracking
			Yes/No
1	0	2.5°	No
2	0	2.5°	No
3	0	2.5°	No
4	-30	3.0°	No
5	-30	3.0°	No
6	-30	3.0°	No

### 5. Hardness, Shore “D”

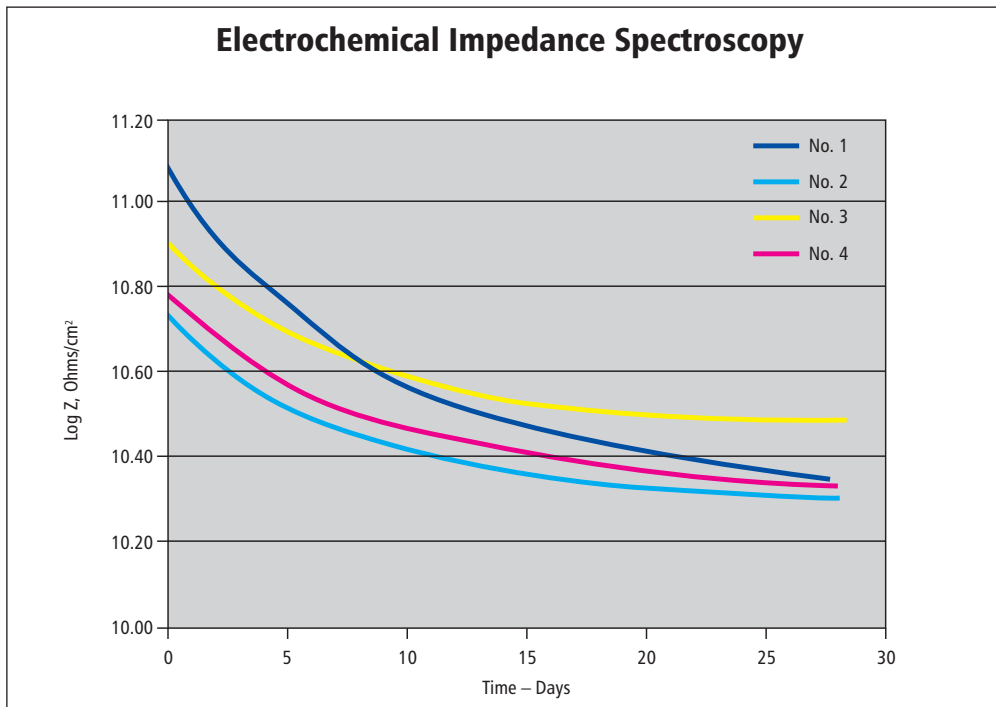
Specimen No.	DFT, milss	Test Temp °C	Hardness Measurements										
			1	2	3	4	5	6	7	8	9	10	Average
1	21	-30	86	87	92	87	85	87	85	87	90	86	87.2
2	20	-10	88	87	86	85	85	84	86	87	86	88	86.2
3	19	0	85	86	85	85	85	85	85	85	86	86	85.3
4	21	20	82	82	81	84	85	85	84	84	84	85	83.6
5	19	65	80	82	81	83	82	82	84	83	83	84	82.4
6	19	75	84	82	83	82	83	82	83	82	81	82	82.4

## 6. Abrasion Resistance

Specimen No.	Load, Kg	No. Cycles	Weight loss, g	Taber wear index	Thickness loss, mils	Wear cycles/mil
1	1	1,000	0.0610	0.0610	0.58	1724
2	1	5000	0.2619	0.0524	3.30	1515

## 7. Electrochemical Impedance Spectroscopy

Average Dry ilm Thickness in Mils,	
Sample No.	Thickness
1	15.5
2	16.0
3	23.0
4	16.5



## 8. Gouge Test

Specimen No.	DFT, mils	Load, Kg	Surface scrape or groove	Penetration* to steel (Holiday)
1	12.3	25	Yes	No
2	14.0	30	Yes	No
3	15.0	35	Yes	No
4	16.3	40	Yes	No
5	20.8	45	Yes	No
6	21.5	50	Yes	No

\*Holiday detection: 67.5 volt DC with wet sponge.

### Conclusion:

The test results reported herein either meet or exceed the minimum acceptance criteria as stated In Table 2 of CAN/CSA Standard Z245.20-98 “External Fusion Bond Epoxy Coating for Steel Pipe”.