

Salt Spray Test Report

Overview and Background

EPCO uses 304 and 316 series stainless steel in the manufacture of its more than 800 different bow and stern eyes as well as the various plates, nuts, washers, etc. that make up the completed product. The same stainless steels are used in the production of the other stainless components that are found in EPCO's total stainless steel product lines. EPCO's vendors supply material certifications of the chemistry for the stainless steel EPCO uses in its daily production process.

Stainless steel has been used in the manufacture of marine components for its strength, corrosion resistance and appearance. The 304 series material has been used by EPCO for its bow eyes for more than 40 years and has demonstrated excellent corrosion resistance properties. The 316 series has even better corrosion resistance for high salt exposure applications.

EPCO had Salt Spray Environmental Exposure Testing conducted by Edglo Laboratories, Inc. to establish a more definitive way of providing a measure of corrosion resistance performance for its 304 and 316 series stainless steel products.

The 304 and 316 series stainless steel products and components were randomly selected and were subjected to a lengthy and unrelenting 336-hour salt spray test. The results are presented as representations of reasonable expectations of EPCO's manufactured products' performance in similar salt environment conditions.

The 336-hour test duration was selected because that test is much longer and more extreme than normally would be requested for evaluation.

Statement of Compliance

All the products that EPCO produces meet or exceed the requirements for that product as defined by [ABYC H-40 \(PDF\)](#).

The results from the Salt Spray Environmental Exposure Testing performed on the various parts submitted in two (2) batches to Edglo Laboratories May 11 and July 23, 2003 respectively are contained in the following pages. The testing was performed according to ASTM B117-90 specifications using a 5% by weight solution of Sodium Chloride at a temperature of 95 degrees Fahrenheit. The Salt Solution is applied at a rate to meet the collection requirements of 1 – 2 mls/hr/80cm².

The samples were submitted using the following product descriptions:

- A. May 11, 2003 , 316 Stainless Steel, Various Part Descriptions, Natural, Hand Polish and KF Finishes.
- B. May 11, 2003 , 304 Stainless Steel, Various Part Descriptions, Natural, Hand Polish and KF Finishes.
- C. May 11, 2003 , 304 Stainless Steel, Various Part Descriptions, All KF Finishes.
- D. July 23, 2003 , 316 Stainless Steel, Various Part Descriptions, Natural Finish.
- E. July 23, 2003 , 316 Stainless Steel, Various Part Descriptions, Electropolished.
- F. July 23, 2003 , 304 Stainless Steel, Various Part Descriptions, Natural.
- G. July 23, 2003 , 304 Stainless Steel, Various Part Descriptions, Electropolished.

Project Description

All individual parts were tested using ASTM B117 for Environmental Salt Spray Corrosion Resistance Testing for 336 hours. This environmental exposure testing procedure is designed to accelerate environmental exposure and its effects on metal parts with various alloys, surface treatments including passivation and electropolishing for Stainless Steel alloys under controlled conditions. Due to the wide range of metals and applications, no specific conversion factors can be applied to the salt spray exposure time versus actual natural environmental exposure.

The parts were tested using the Salt Spray Methodology without pre-cleaning: i.e. the parts were tested as received. The parts were cleaned post exposure using tap water and laboratory reagent water rinses followed by air-drying.

The parts were evaluated based on observational data during the exposure testing period. Additional Protection Rating (R) data was calculated using ASTM B537. The Protection Rating is based on the % of total surface area deemed defective. The areas evaluated are limited to significant surface areas of the part(s). Edges, threads and bleeding or creep from these locations are not evaluated or including in the Protection Rating. Defects were observationally defined

as those impacting the significant surface areas of the parts.

The maximum rating is assigned a value of 10 (0%). The ratings are then based on the area of defects (as a percent of total surface area) in descending order from 9 – 0.

Sampling

Sample Description:

Individual parts were provided in quantities of 1-3 for each Alloy/Finish configuration. The exposure testing was performed on the parts as received with no additional surface treatment performed.

Sample Preparation:

None. Parts placed into Salt Spray Chamber as they were received. The parts all appeared to have no surface dust or residue on the significant surface area.

Sample Analysis:

The parts were exposed to the conditions of the Salt Spray Chamber according to the specifications of ASTM B117 for a total period of 336 hours of continuous exposure. The cabinet was checked as 24-Hour intervals for method based quality control procedures. The parts were also observed at the same 24-hour intervals for the presence of surface corrosion.

Sample Results and Discussion:

Observational Data

The observational data for each part set has been summarized on the attached forms in a spreadsheet format. The presence of corrosion is indicated by a short description of the corrosion, the location on the part and the hour interval of first observation.

Performance Data

The second set of summary reports lists the part descriptions, finish description, date of testing (Start, Finish), total hours, Total Area of defects and Protection Rating (R).

Salt Spray Environmental Exposure Test

Combined Testing Results**Summary:**

August 25, 2003

304 Stainless Steel

Part ID (Qty)	Finish Description	Date Testing Initiated	Date Testing Completed	Total Hours	Total Area of Defects (%) A	ASTM B537 Protection Rating R (Scale 10 – 0) [3*(2-logA)]
0.446" RD (3)	Natural	May 21, 2003	June 5, 2003	336	0	10
0.446" RD (3)	KF Finish	May 21, 2003	June 5, 2003	336	0	10
0.331" RD (3)	Natural	May 21, 2003	June 5, 2003	336	0	10
0.331" RD (3)	KF Finish	May 21, 2003	June 5, 2003	336	0	10
Sm Curved End Plate (3)	Natural	May 21, 2003	June 5, 2003	336	0	10
Lg Curved End Plate (3)	Natural	May 21, 2003	June 5, 2003	336	0	10
Small Rectangular Plate (3)	Natural	May 21, 2003	June 5, 2003	336	0	10
Large Rectangular Plate (3)	Natural	May 21, 2003	June 5, 2003	336	0	10
Small Nuts (3)	Natural	May 21, 2003	June 5, 2003	336	0	10
Medium Nuts	Natural	May 21, 2003	June 5, 2003	336	0	10

(3)							
Large Nuts (3)	Natural	May 21, 2003	June 5, 2003	336	0.1		9
Thin Nuts (3)	Natural	May 21, 2003	June 5, 2003	336	0.1		9
Sm Lock Washer (3)	Natural	May 21, 2003	June 5, 2003	336	0		10
Lg Lock Washer (3)	Natural	May 21, 2003	June 5, 2003	336	0		10
Small Washer (3)	Natural	May 21, 2003	June 5, 2003	336	0		10
Large Washer (3)	Natural	May 21, 2003	June 5, 2003	336	0		10
Sm Curved End Plate (3)	KF Finish	May 21, 2003	June 5, 2003	336	0		10
Lg Curved End Plate (3)	KF Finish	May 21, 2003	June 5, 2003	336	0		10
Small Rectangular Plate (3)	KF Finish	May 21, 2003	June 5, 2003	336	0		10
Large Rectangular Plate (3)	KF Finish	May 21, 2003	June 5, 2003	336	0		10
Small Nuts (3)	KF Finish	May 21, 2003	June 5, 2003	336	0		10
Large	KF Finish	May 21, 2003	June 5, 2003	336	0		10

Nuts (3)						
Small Thin	KF Finish	May 21, 2003	June 5, 2003	336	0	10
Nuts (3)						
Large Thin	KF Finish	May 21, 2003	June 5, 2003	336	0	10
Nuts (3)						

Combined Testing Results

Summary: August 25,
2003

304 Stainless Steel Natural

Part ID (Qty)	Finish Description	Date Testing Initiated	Date Testing Completed	Total Hours	Total Area of Defects (%) A	ASTM B537 Protection Rating R (Scale 10 – 0) [3*(2-logA)]
3/8" U-Bolt (1)	Natural	July 24, 2003	August 7, 2003	336	0	10
1/2" U-Bolt (1)	Natural	July 24, 2003	August 7, 2003	336	0.1	9
3/8" HFN (2)	Natural	July 24, 2003	August 7, 2003	336	0	10
1/2" HFN (2)	Natural	July 24, 2003	August 7, 2003	336	0.1	9
3/8" Top Nuts (2)	Natural	July 24, 2003	August 7, 2003	336	0	10
1/2" Top Nuts (2)	Natural	July 24, 2003	August 7, 2003	336	0.1	9

3/8" Bow Plates (2)	Natural	July 24, 2003	August 7, 2003	336	0.1	9
1/2" Bow Plates (2)	Natural	July 24, 2003	August 7, 2003	336	0.2	8
3/8" Stern Plates (2)	Natural	July 24, 2003	August 7, 2003	336	0	10
1/2" Stern Plates (2)	Natural	July 24, 2003	August 7, 2003	336	0.1	9
3/8" Washers (2)	Natural	July 24, 2003	August 7, 2003	336	0	10
1/2" Washers (2)	Natural	July 24, 2003	August 7, 2003	336	0	10
3/8" Lock Washers (2)	Natural	July 24, 2003	August 7, 2003	336	0	10
1/2" Lock Washers (2)	Natural	July 24, 2003	August 7, 2003	336	0	10

Combined Testing Results

Summary: August 25,

2003

304 Stainless Steel Electropolished

Part ID (Qty)	Finish Description	Date Testing Initiated	Date Testing Completed	Total Hours	Total Area of Defects (%) A	ASTM B537 Protection Rating R (Scale 10 – 0) [3*(2-logA)]
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3/8" U-Bolt (1)	Electropolished	July 24, 2003	August 7, 2003	336	0	10
1/2" U-Bolt (1)	Electropolished	July 24, 2003	August 7, 2003	336	0	10
3/8" Stern Plates (2)	Electropolished	July 24, 2003	August 7, 2003	336	0	10

Combined Testing Results

Summary: August 25,
2003

316 Stainless Steel

Part ID (Qty)	Finish Description	Date Testing Initiated	Date Testing Completed	Total Hours	Total Area of Defects (%) A	ASTM B537 Protection Rating R (Scale 10 – 0) [3*(2-logA)]
0.331" RD (2)	Natural	May 21, 2003	June 5, 2003	336	0	10
0.331" RD (2)	Hand Polish	May 21, 2003	June 5, 2003	336	0	10
0.446" RD (1)	KF Finish	May 21, 2003	June 5, 2003	336	0	10
3/8", 1/2" (3,3) Nuts	Natural	May 21, 2003	June 5, 2003	336	0	10
0.446" RD (2)	Natural	May 21, 2003	June 5, 2003	336	0	10
0.446" RD (1)	Hand Polish	May 21, 2003	June 5, 2003	336	0	10

Combined Testing Results

Summary: August 25,
2003

316 Stainless Steel Natural						
Part ID (Qty)	Finish Description	Date Testing Initiated	Date Testing Completed	Total Hours	Total Area of Defects (%) A	ASTM B537 Protection Rating R (Scale 10 – 0) [3*(2-logA)]
3/8" U-Bolt (1)	Natural	May 21, 2003	June 5, 2003	336	0	10
1/2" U-Bolt (1)	Natural	May 21, 2003	June 5, 2003	336	0	10
3/8" HFN (2)	Natural	May 21, 2003	June 5, 2003	336	0	10
1/2" HFN (2)	Natural	May 21, 2003	June 5, 2003	336	0	10
3/8" Top Nuts (2)	Natural	May 21, 2003	June 5, 2003	336	0	10
1/2" Top Nuts (2)	Natural	May 21, 2003	June 5, 2003	336	0	10
3/8" Bow Plates (2)	Natural	May 21, 2003	June 5, 2003	336	0.2	8
1/2" Bow Plates (2)	Natural	May 21, 2003	June 5, 2003	336	0.2	8
3/8" Stern Plates (2)	Natural	May 21, 2003	June 5, 2003	336	0.2	8
1/2" Stern Plates (2)	Natural	May 21, 2003	June 5, 2003	336	0.2	8
3/8" Washers (2)	Natural	May 21, 2003	June 5, 2003	336	0	10
1/2" Washers (2)	Natural	May 21, 2003	June 5, 2003	336	0	10
3/8" Lock Washers (2)	Natural	May 21, 2003	June 5, 2003	336	0	10

Combined Testing Results

Summary: August 25,

2003

316 Stainless Steel Electropolished

Part ID (Qty)	Finish Description	Date Testing Initiated	Date Testing Completed	Total Hours	Total Area of Defects (%) A	ASTM B537 Protection Rating R (Scale 10 – 0) [3*(2-logA)]
3/8" U-Bolt (1)	Electropolished	July 24, 2003	August 7, 2003	336	0	10
1/2" U-Bolt (1)	Electropolished	July 24, 2003	August 7, 2003	336	0	10
3/8" Top Nuts (2)	Electropolished	July 24, 2003	August 7, 2003	336	0	10
1/2" Top Nuts (2)	Electropolished	July 24, 2003	August 7, 2003	336	0	10
3/8" Bow Plates (2)	Electropolished	July 24, 2003	August 7, 2003	336	0.1	9
1/2" Bow Plates (2)	Electropolished	July 24, 2003	August 7, 2003	336	0	10
3/8" Stern Plates (2)	Electropolished	July 24, 2003	August 7, 2003	336	0.1	9
1/2" Stern Plates (2)	Electropolished	July 24, 2003	August 7, 2003	336	0.1	9