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TEST REPORT

Send To: C0281169

Mr. Steven Wang
Shandong Efield Piping System Co., Ltd.
No.2369 Yikang Road
Tengzhou, Shandong 277500
China

Facility: C0281170

Shandong Efield Piping System Co., Ltd.
No.2369 Yikang Road
Tengzhou, Shandong 277500
China

Result: PASS

Report Date: 9-August-2016

Customer Name: Shandong Efield Piping System Co., Ltd.
Tested To: ASTM F2023 and NSF 14
Description: 1/2" PEX tubing
Test Type: Chlorine Resistance Dependent Transfer Testing
Trade Designation: Efield PEX Tubing Blue
Job Number: J-00208395
Project Number: 16-2666 / W0270769
Project Manager: Jialei (Karen) L. Sun

Thank you for having your product tested by NSF International.

Please contact your Project Manager if you have any questions or concerns pertaining to this report.

Report Authorization:

Dan Andronescu, B. Eng.
Engineering Specialist

Authority:

Michael Conrad, Ph.D., P. Eng.
Laboratory Manager



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1.0 Purpose of Test

The purpose of Project 16-2666 / J-00208395 was to conduct chlorine resistance testing of a 1/2" blue PEX in accordance with F2023-15¹.

2.0 Test Item Identification and Description

The following sample, as shown in **Table 1**, was provided by the Client. No further details of the sample were provided.

Table 1: Sample Description

Sample ID	Description	Printline
16-164	1/2" Blue PEX coil	N/A

3.0 Test Methods

Chlorine Resistance Testing was performed in accordance with ASTM F2023-15¹.

Testing to ASTM F2023 is within NSF Canada's ISO 17025 scope of accreditation (I.A.S. TL-256).

4.0 Test Details

Specimens were tested as 15" lengths with standard ASTM F1807 brass insert crimp fittings on both pipe ends. The length to diameter ratio was nominally 24.

Chlorine resistance testing was conducted in NSF Canada's Advanced Performance Testing Facility. Specimens were exposed to continuous flowing chlorinated Reverse Osmosis water and tested under conditions as detailed below in **Tables 2 and 3**.

¹ ASTM F2023-15 *Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water*



Table 2: Primary Test Variables and Control Limits

Parameter	Nominal	Control Limits
pH	6.8	± 0.2
Chlorine (mg/L)	4.4	± 0.2
ORP (mV)	> 825	Measured
Fluid Temperature (°C)*	115	± 1
Air Temperature (°C)*	115	± 1
Fluid Pressure (psig)	See Table 3	± 3
Flow Rate (USGPM)	0.1	± 10%

* The Fluid and Air Temperatures are controlled at the same set-point. No measurable temperature drop across the test specimens is observed.

5.0 Results

Testing of five specimens was initiated. All specimens were removed as non-failures. Table 3 summarizes the test results.

A minimal layer of degradation, little to no micro-cracking and little to no radial cracking was observed on the inner surface for four of the specimens. A moderate layer of degradation, extensive micro cracking and moderate radial cracking was observed for one of the specimens. No discoloration was observed at the outer surface for all specimens. Specimen details are provided in Appendix A. The overall test summary is provided in Appendix B.

Table 3: Test Results

Specimen ID	Temperature (°C)	Pressure (psig)	Stress (psi)	Test Time (h)	ASTM F2023 95% Lower Prediction Limit (h)
16-164-01	115	60	222	1,031	1,016
16-164-02			226	1,032	1,003
16-164-03			225	1,045	1,008
16-164-04		40	149	1,517	1,324
16-164-05			149	1,449	1,328

6.0 Discussion

Specimens were tested at two of the original ASTM F2023 test conditions at the highest temperature. Three specimens were tested at 115°C/60 psig and two specimens were tested at 115°C/40 psig. Table 3 summarizes the specimen test times with the 95% LPL (Lower Prediction Limit) predicted by the ASTM F2023 data set.



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The data was analyzed in accordance with NSF/ANSI 14-2015. All specimens meet their 95% LPL values. As a result, the sample meets the requirements for oxidative resistance equivalency.

7.0 Conclusions

Based on the sample provided and the testing performed in this project, the following conclusion was made:

- When tested in accordance with Annex A1 of ASTM F2023-15 and analyzed per NSF/ANSI 14-2015, Sample 16-164 meets the requirements for oxidative resistance equivalency.



Appendix A

Specimen Details

Table A1: Specimen Details

Specimen ID	16-164-01	16-164-02	16-164-03	16-164-04	16-164-05
Temperature (°C)	115	115	115	115	115
Pressure (psig)	60	60	60	40	40
Chlorine (mg/L)	4.4	4.4	4.4	4.4	4.4
pH	6.8	6.8	6.8	6.8	6.8
Test Time (h)	1,031	1,032	1,045	1,517	1,449
Original outside diameter (mm)	15.93	15.95	15.95	15.96	15.96
Original average wall thickness (mm)	1.93	1.91	1.93	1.91	1.94
Original minimum wall thickness (mm)	1.90	1.87	1.88	1.88	1.89
Failure Type	Non-failure	Non-failure	Non-failure	Non-failure	Non-failure
Crack Length (mm)	N/A	N/A	N/A	N/A	N/A
Distance From Inlet (mm)	N/A	N/A	N/A	N/A	N/A
Clock Position*	N/A	N/A	N/A	N/A	N/A
Initiation Point	N/A	N/A	N/A	N/A	N/A
Fitting Type	Brass	Brass	Brass	Brass	Brass

* Circumferential position of failure taken from inlet



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Appendix B

Test Summary

TEST LABORATORY:	NSF Canada										
LOCATION:	280B Industrial Parkway S. Aurora, Ontario L4G 3T9 Canada										
TESTING STARTED:	16-05-03										
TESTING COMPLETED:	16-07-25										
CHLORINE SOURCE:	Chlorine Gas										
TUBING NOMINAL ID:	1/2"										
TUBING MANUFACTURER:	Shandong Efield Piping System										
TRADE DESIGNATION:	Efield PEX Tubing Blue										
TUBING LOT NUMBER:	Not Provided										
RESIN MANUFACTURER:	Hyundai										
COMPOUND DESIGNATION:	Polylink XP650/XC200										
FITTING:	<table> <tr> <td>Manufacturers Name:</td> <td>Not Applicable</td> </tr> <tr> <td>Model or Designation:</td> <td>Not Applicable</td> </tr> <tr> <td>Fitting Type:</td> <td>Insert</td> </tr> <tr> <td>Material:</td> <td>Brass</td> </tr> <tr> <td>ASTM Standard:</td> <td>F1807</td> </tr> </table>	Manufacturers Name:	Not Applicable	Model or Designation:	Not Applicable	Fitting Type:	Insert	Material:	Brass	ASTM Standard:	F1807
Manufacturers Name:	Not Applicable										
Model or Designation:	Not Applicable										
Fitting Type:	Insert										
Material:	Brass										
ASTM Standard:	F1807										
SPECIMEN POSITION:	Horizontal										