TEST REPORT

REPORT NUMBER: 100219271TOR-006R1
ISSUE DATE: June 28, 2011
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EVALUATION CENTER

Intertek Testing Services Ltd.
6225 Kenway Drive
Mississauga, ONTARIO L5T 2L3

RENDERED TO

Mr. Jim Wadaga
Noble Company
7300 Enterprise Drive
Spring Lake, MI 49456

PRODUCT EVALUATED
Chlorinated Polyethylene Membrane

EVALUATION PROPERTY
Water Vapour Transmission

Report of Testing of Chlorinated Polyethylene Membrane for compliance with the applicable requirements of the following criteria: *ASTM E 96/E 96M-05 Standard test methods for Water Vapour Transmission of Materials*

1 Table of Contents

2 Introduction

Intertek has conducted testing for Mr. Jim Wadaga, on NobleSeal TS and Chloraloy chlorinated polyethylene membrane, to evaluate for Water Vapour Transmission. Testing was conducted in accordance with standard methods of ASTM E 96/E 96M-05, Water Vapour Transmission as per Procedure A, Desiccant Method. This evaluation began on March 24, 2011 and was completed on April 18, 2011.

3 Test Specimen

3.1. SPECIMEN SELECTION

One rolled specimen of each membrane type, 5 feet wide was submitted for testing. Specimens were submitted to Intertek directly from the client. Specimens were not independently selected for testing. Specimens were received at the Evaluation Center on September 21, 2010.

3.2. SPECIMEN AND ASSEMBLY DESCRIPTION

The NobleSeal TS membranes are designed to provide thin bed waterproofing, crack isolation of thin-set tile, and may be used to bridge control joints. The membranes are made from Chlorinated Polyethylene (CPE) with non-woven fiber laminated on both sides.

The Chloraloy membranes are designed to provide waterproofing under a full mortar bed for installation of tiles or stones. The membranes are made from Chlorinated Polyethylene (CPE) and are gray in colour.

4 Testing and Evaluation Methods

4.1. SPECIMEN PREPARATION

All specimens were cut to the required dimensions at Intertek Testing Services laboratory according to ASTM E 96/E 96M-05.

4.2. CONDITIONING

Prior to testing the specimens were conditioned at 23 ± 2°C and 50 ± 5% relative humidity for a minimum of 24 hours.

4.3. TEST PROCEDURES

4.3.1. TEST STANDARD

Water Vapor Transmission (WVT) was evaluated in accordance with ASTM E96-05. Four specimens of the NobleSeal TS membrane, measuring 133.54 mm (5.26 in.) in diameter were cut from the flattest section of the specimen and had an average thickness of 1.02 mm (0.04 in.) thick. Four specimens of the Chloraloy membrane, measuring 133.54 mm (5.26 in.) in diameter were cut from the flattest section of the specimen and had an average thickness of 1.15 mm (0.05 in.) thick. Each specimen was weighed and measured for thickness prior to being sealed to the dish.

The dish, made from stainless steel was cleaned and free of moisture prior to filling with desiccant. The desiccant was dried at a temperature of 200°C (400°F) for a period of 24 hours, and allowed to cool in a moisture free environment until it reached room temperature. The dishes were then filled with desiccant with 6 mm (1/4 in.) of space from the specimen. The specimen was then placed on to the dish and sealed around the perimeter with melted beeswax. The test specimens were conditioned at 23 ± 2°C (73 ± 5°F) and 50 ± 5% relative humidity and periodic weight measurements taken every three or four days. Measurements continued until the sample's rate of weight change was noted to stabilize.

The water vapour permeance was calculated as follows:

Water Vapour Permeance (inch pound units):

$WVP = G/tA = (G/t)/A$ Where G = weight change, grains (from the straight line)
t = time during which G occurred, h
G/t = slope of the straight line, grains/h
A = test area (cup mouth area), ft^2
WVP = rate of water vapour transmission, grains/h·ft^2

Permeance:

$Permeance = WVP/\Delta p = WVT/S\ (R1-R2)$

Where: Δp = vapour pressure difference, in. Hg
S = saturation vapour pressure at test temperature, in. Hg
R1 = relative humidity at the source expressed as a fraction (test chamber)
R2 = relative humidity at the vapour sink expressed as a fraction

Permeability = Permeance x Thickness

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

The sample test results are shown in Table 1 below. A full set of test data is included in Appendix A.

Table 1. Test Results of NobleSeal TS Chlorinated Polyethylene Membrane

Property	Specimen 1	Specimen 2	Specimen 3	Average
Water Vapour Permeance at thickness tested, perms (ng/Pa·s·m^2)	0.14 (7.90)	0.17 (9.47)	0.19 (10.7)	0.16 (9.36)
Water Vapour Permeability, perm inch (ng/Pa·s·m)	0.0056 (0.0082)	0.0064 (0.0093)	0.0078 (0.0113)	0.0066 (0.0096)

The sample test results are shown in Table 2 below. A full set of test data is included in Appendix B.

Table 2. Test Results of Chloraloy Chlorinated Polyethylene Membrane

Property	Specimen 1	Specimen 2	Specimen 3	Average
Water Vapour Permeance at thickness tested, perms (ng/Pa·s·m^2)	0.06 (3.65)	0.07 (3.76)	0.07 (4.06)	0.07 (3.83)
Water Vapour Permeability, perm inch (ng/Pa·s·m)	0.0030 (0.0044)	0.0029 (0.0042)	0.0031 (0.0045)	0.0030 (0.0044)

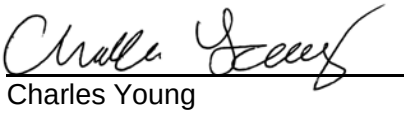
6 Conclusion

The NobleSeal TS and Chloraloy chlorinated polyethylene membranes reported herein have been tested in accordance with E 96/E 96M-05, Water Vapour Transmission, Procedure A, Desiccant Method.

The conclusions of this test report may not be used as part of the requirements for Intertek product certification. Authority to Mark must be issued for a product to become certified.

INTERTEK TESTING SERVICES NA LTD.

Tested and
Reported by: 
Allan Lawrence
Technical Analyst, Building Products

Reviewed by: 
Charles Young
Technical Analyst, Building Products

7 Appendix A: NobleSeal TS CPE Membrane

Test: **Water Vapor Transmission**
Date: 24-Mar-11
Client: Noble Company
Product: CPE Membrane - NobleSeal TS
Orientation: Exterior Side up
Test Methods: ASTM E96/E96M-05, *Test Methods for Water Vapour Transmission of Materials*
Test Procedure: Dessicant Method
Conditioning: 24 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 2%
Equipment: **Balance:** 280 01 0075, Oct. 2011
Test Chamber: 280 01 0133, Nov. 2011
Digital Calipers: 280 08 0909, Nov. 5/11

Project: G100219271
Eng/Tech: Allan Lawrence A.L.
Reviewer: Charles Young CEY

Measurement	Control	Sp. 1	Sp. 2	Sp. 3
Q1 thickness	1.00	1.03	0.94	1.05
Q2 thickness	1.02	1.03	1.00	1.05
Q3 thickness	1.00	1.05	1.00	1.05
Q4 thickness	1.02	1.03	0.99	1.08
Desiccant Mass (g)	0.0	289.0	292.4	301.1
Air Gap thickness (mm)	6.3	6.3	6.3	6.3
Mask Width (mm)	5.0	5.1	4.8	5.2
Assembly height (mm)	46.6	46.3	46.3	46.5
Assembly diameter (mm)	96.7	96.7	96.7	96.7

Air Velocity Evaluation		
Initial Air Velocity	0.20	m/s
Final Air Velocity	0.20	m/s
Velocity Minimum Control Limit	0.02	m/s
Velocity Maximum Control Limit	0.3	m/s
Constants		
Standard Atmospheric Pressure	101325	Pa
Ideal Gas Constant for water	461.5	J/kg.K
Gas Constant for Dry Air	287.055	J/kgK
Density of Material of Balance Weights	8000	kg/m^3

Time (mm/dd/yy hh:mm)	Temp. (°C)	RH (%)	Baro. Pressure (mm Hg)	Baro. Pressure (kPa)	Mass of Control (g)	Mass of Assembly 1 (g)	Mass of Assembly 2 (g)	Mass of Assembly 3 (g)
3/24/11 16:30	23.0	50.0	741.7	98.8	91.15	380.19	383.29	394.39
3/29/11 16:30	23.0	50.0	746.8	99.5	91.15	380.22	383.33	394.44
4/1/11 16:30	23.0	50.0	728.7	97.1	91.15	380.26	383.37	394.47
4/4/11 16:30	23.0	50.0	727.5	96.9	91.16	380.30	383.42	394.52
4/8/11 16:30	23.0	50.0	743.7	99.1	91.16	380.31	383.44	394.55
4/11/11 16:30	23.0	50.0	728.7	97.1	91.16	380.34	383.46	394.58
4/15/11 16:30	23.0	50.0	751.3	100.1	91.16	380.36	383.49	394.61
4/18/11 16:30	23.0	50.0	741.7	98.8	91.16	380.38	383.52	394.65

Elapsed Time (hours)	Density of Air (kg/m^3)
0.0	1.1623
120.0	1.1703
192.0	1.1419
264.0	1.1401
360.0	1.1654
432.0	1.1419
528.0	1.1774
600.0	1.1623

Control Change (g)	Corrected Control (g)	Corrected Assembly 1 (g)	Corrected Assembly 2 (g)	Corrected Assembly 3 (g)
0.000	91.536	380.530	383.629	394.729
0.003	91.538	380.560	383.669	394.779
-0.007	91.529	380.601	383.710	394.810
0.003	91.538	380.631	383.750	394.850
0.011	91.547	380.640	383.769	394.879
0.003	91.539	380.671	383.790	394.910
0.015	91.551	380.690	383.819	394.939
0.010	91.546	380.710	383.849	394.979

Test: **Water Vapor Transmission** **Project:** G100219271
Date: 27-Apr-11 **Eng/Tech:** Allan Lawrence
Client: Noble Company **Reviewer:** Charles Young
Product: CPE Membrane - NobleSeal TS
Orientation: Exterior Side up
Test Methods: ASTM E96/E96M-05, *Test Methods for Water Vapour Transmission of Materials*
Test Procedure: Dessicant Method
Conditioning: 24 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 2%
Equipment: **Balance:** 280 01 0075, Oct. 2011
Test Chamber: 280 01 0133, Nov. 2011
Digital Calipers: 280 08 0909, Nov. 5/11

Measurement	Specimen		
	1	2	3
Mean Barometric Pressure (kPa)	98.42	98.42	98.42
Mean Air Temperature (°C)	23.0	23.0	23.0
Mean Saturation Vapour Pressure[1] (Pa)	2855	2855	2855
Mean Relative Humidity in chamber (%)	50.0	50.0	50.0
Relative Humidity in test dish (%)	0	0	0
Specimen Weight Change (g)	0.180	0.220	0.250
Moisture Gain of Dessicant (%)	0	0	0
Moisture Gain Control Limit (%)	10	10	10
Effective Test Dish Diameter (mm)	96.7	96.7	96.7
Effective Test Area (m²)	0.0073	0.0073	0.0073
Gradient of weight/time graph (g/hour)	0.0003	0.0004	0.0004
Specimen Mean Thickness (mm)	1.04	0.98	1.06
Uncorrected Water Transmission (g/hour.m²)	4.10E-02	4.91E-02	5.55E-02
Uncorrected Water Permeance (ng/Pa.s.m²)	7.97E+00	9.55E+00	1.08E+01
Permeability of Still Air (ng/Pa.s.m)	2.01E+02	2.01E+02	2.01E+02
Permeance of Still Air (ng/Pa.s.m²)	3.22E+04	3.22E+04	3.22E+04
Vapor Resistance of Still Air (m².s.Pa/kg)	3.11E+07	3.11E+07	3.11E+07
Surface Resistances (m².s.Pa./kg)	4.00E+07	4.00E+07	4.00E+07
Total Still Air and Specimen Surface (m².s.Pa/kg)	7.11E+07	7.11E+07	7.11E+07
Four Times Test Area Divided By Perimeter (m)	9.67E-02	9.67E-02	9.67E-02
Excess Water Transmission Due to Mask (%)	0.94	0.90	0.97
Excess Water Permeance Due to Mask (ng/Pa.s.m²)	7.53E-02	8.58E-02	1.04E-01
Mask-corrected Water Permeance (ng/Pa.s.m²)	7.90E+00	9.47E+00	1.07E+01
Water Vapour Transmission (g/hour.m²)	4.06E-02	4.87E-02	5.50E-02
Water Vapour Permeance (ng/Pa.s.m²)	7.90	9.47	10.70
Water Vapour Permeance (perms)	0.14	0.17	0.19
Water Vapour Permeability (ng/Pa.s.m)	0.0082	0.0093	0.0113
Water Vapour Permeability (Perm inch)	0.0056	0.0064	0.0078

[1]Estimated by the Clausius-Clapeyron equation

Test Result Summary	Metric units	Imperial Units
Water Vapor Transmission	0.05 g/hr.m²	0.07 grns/hr.ft²
	1.15 g/day.m²	1.65 grns/day.ft²
Water Vapor Permeance	9.36 ng/Pa.s.m²	0.16 perms
	0.0004 per 25 mm	0.0066 per in.
Water Vapor Permeability	0.0096 ng/Pa.s.m	0.0066 Perm inch

8 Appendix B: Chloraloy CPE Membrane

Test: **Water Vapor Transmission** **Project:** G100219271
Date: 24-Mar-11 **Eng/Tech:** Allan Lawrence
Client: Noble Company **Reviewer:** Charles Young
Product: CPE Membrane - Chloraloy
Orientation: Exterior Side up
Test Methods: ASTM E96/E96M-05, *Test Methods for Water Vapour Transmission of Materials*
Test Procedure: Dessicant Method
Conditioning: 24 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 2%
Equipment: **Balance:** 280 01 0075, Oct. 2011
Test Chamber: 280 01 0133, Nov. 2011
Digital Calipers: 280 08 0909, Nov. 5/11

Measurement	Control	Sp. 1	Sp. 2	Sp. 3
Q1 thickness	1.22	1.18	1.14	1.12
Q2 thickness	1.18	1.18	1.12	1.10
Q3 thickness	1.17	1.21	1.12	1.09
Q4 thickness	1.19	1.21	1.13	1.10
Desiccant Mass (g)	0.0	286.2	292.4	296.4
Air Gap thickness (mm)	6.3	6.3	6.3	6.3
Mask Width (mm)	4.5	4.5	5.1	5.2
Assembly height (mm)	46.1	47.1	46.9	47.6
Assembly diameter (mm)	96.7	96.7	96.7	96.7

Air Velocity Evaluation		
Initial Air Velocity	0.20	m/s
Final Air Velocity	0.20	m/s
Velocity Minimum Control Limit	0.02	m/s
Velocity Maximum Control Limit	0.3	m/s
Constants		
Standard Atmospheric Pressure	101325	Pa
Ideal Gas Constant for water	461.5	J/kg.K
Gas Constant for Dry Air	287.055	J/kgK
Density of Material of Balance Weights	8000	kg/m^3

Time (mm/dd/yy hh:mm)	Temp. (°C)	RH (%)	Baro. Pressure (mm Hg)	Baro. Pressure (kPa)	Mass of Control (g)	Mass of Assembly 1 (g)	Mass of Assembly 2 (g)	Mass of Assembly 3 (g)
3/24/11 16:30	23.0	50.0	741.7	98.8	101.72	387.89	393.31	398.68
3/29/11 16:30	23.0	50.0	746.8	99.5	101.73	387.91	393.33	398.70
4/1/11 16:30	23.0	50.0	728.7	97.1	101.73	387.91	393.34	398.72
4/4/11 16:30	23.0	50.0	727.5	96.9	101.73	387.94	393.37	398.74
4/8/11 16:30	23.0	50.0	743.7	99.1	101.73	387.96	393.38	398.74
4/11/11 16:30	23.0	50.0	728.7	97.1	101.73	387.97	393.39	398.76
4/15/11 16:30	23.0	50.0	751.3	100.1	101.73	387.97	393.39	398.77
4/18/11 16:30	23.0	50.0	741.7	98.8	101.73	387.97	393.4	398.78

Elapsed Time (hours)	Density of Air (kg/m^3)
0.0	1.1623
120.0	1.1703
192.0	1.1419
264.0	1.1401
360.0	1.1654
432.0	1.1419
528.0	1.1774
600.0	1.1623

Control Change (g)	Corrected Control (g)	Corrected Assembly 1 (g)	Corrected Assembly 2 (g)	Corrected Assembly 3 (g)
0.000	102.100	388.236	393.653	399.028
0.013	102.113	388.246	393.663	399.038
0.003	102.103	388.247	393.674	399.059
0.003	102.103	388.277	393.704	399.079
0.011	102.111	388.296	393.713	399.078
0.003	102.103	388.307	393.724	399.099
0.015	102.115	388.306	393.723	399.108
0.010	102.110	388.306	393.733	399.118

Test: **Water Vapor Transmission** **Project:** G100219271
Date: 27-Apr-11 **Eng/Tech:** Allan Lawrence
Client: Noble Company **Reviewer:** Charles Young
Product: CPE Membrane - Chloraloy
Orientation: Exterior Side up
Test Methods: ASTM E96/E96M-05, *Test Methods for Water Vapour Transmission of Materials*
Test Procedure: Dessicant Method
Conditioning: 24 hours at a temperature of 23 ± 2°C and relative humidity of 50 ± 2%
Equipment: **Balance:** 280 01 0075, Oct. 2011
Test Chamber: 280 01 0133, Nov. 2011
Digital Calipers: 280 08 0909, Nov. 5/11

Measurement	Specimen		
	1	2	3
Mean Barometric Pressure (kPa)	98.42	98.42	98.42
Mean Air Temperature (°C)	23.0	23.0	23.0
Mean Saturation Vapour Pressure[1] (Pa)	2855	2855	2855
Mean Relative Humidity in chamber (%)	50.0	50.0	50.0
Relative Humidity in test dish (%)	0	0	0
Specimen Weight Change (g)	0.071	0.080	0.090
Moisture Gain of Dessicant (%)	0	0	0
Moisture Gain Control Limit (%)	10	10	10
Effective Test Dish Diameter (mm)	96.7	96.7	96.7
Effective Test Area (m²)	0.0073	0.0073	0.0073
Gradient of weight/time graph (g/hour)	0.0001	0.0001	0.0002
Specimen Mean Thickness (mm)	1.19	1.13	1.10
Uncorrected Water Transmission (g/hour.m²)	1.90E-02	1.95E-02	2.11E-02
Uncorrected Water Permeance (ng/Pa.s.m²)	3.69E+00	3.80E+00	4.10E+00
Permeability of Still Air (ng/Pa.s.m)	2.01E+02	2.01E+02	2.01E+02
Permeance of Still Air (ng/Pa.s.m²)	3.22E+04	3.22E+04	3.22E+04
Vapor Resistance of Still Air (m².s.Pa/kg)	3.11E+07	3.11E+07	3.11E+07
Surface Resistances (m².s.Pa./kg)	4.00E+07	4.00E+07	4.00E+07
Total Still Air and Specimen Surface (m².s.Pa/kg)	7.11E+07	7.11E+07	7.11E+07
Four Times Test Area Divided By Perimeter (m)	9.67E-02	9.67E-02	9.67E-02
Excess Water Transmission Due to Mask (%)	1.09	1.03	1.01
Excess Water Permeance Due to Mask (ng/Pa.s.m²)	4.03E-02	3.91E-02	4.14E-02
Mask-corrected Water Permeance (ng/Pa.s.m²)	3.65E+00	3.76E+00	4.06E+00
Water Vapour Transmission (g/hour.m²)	1.88E-02	1.93E-02	2.09E-02
Water Vapour Permeance (ng/Pa.s.m²)	3.65	3.76	4.06
Water Vapour Permeance (perms)	0.06	0.07	0.07
Water Vapour Permeability (ng/Pa.s.m)	0.0044	0.0042	0.0045
Water Vapour Permeability (Perm inch)	0.0030	0.0029	0.0031

[1]Estimated by the Clausius-Clapeyron equation

Test Result Summary	Metric units	Imperial Units
Water Vapor Transmission	0.02 g/hr.m²	0.03 grns/hr.ft²
	0.47 g/day.m²	0.67 grns/day.ft²
Water Vapor Permeance	3.83 ng/Pa.s.m²	0.07 perms
	0.0002 per 25 mm	0.0030 per in.
Water Vapor Permeability	0.0044 ng/Pa.s.m	0.0030 Perm inch

9 Revision Page

Revision No.	Date	Changes	Author	Reviewer
0	June 28, 2011	First issue	Allan Lawrence	Claudio Sacilotto
1	July 24, 2012	Section 5.1: Water Vapour Permeability corrected values updated. Appendix A and B: Data sheets updated.	Allan Lawrence	Charles Young

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