

CORRESPONDENCE

To: Jeff Bailey Humpty's Fall Breaker
 From: Jason Looij Project No.: 109444
 Date: 13 May 2013 Page: Page 1 of 4
 Subject Interpretation of permeance values

SUMMARY

Humpty's Fall Breaker Ltd has developed a new product to be used as a safety mesh for use in the construction industry. A testing programme has been completed on the product to confirm compliance with AS/NZS 4389:1996. The results of this testing can be found in a separate document.

It is understood that Humpty's Fall Breaker wish to use the safety mesh material as a damp proof membrane (DPM) product, in order to comply the necessary regulations, the material has to be shown to satisfy the New Zealand Building Code (NZBC). The NZBC Standard for determining the water vapour transmission (WVT) has to meet the specifications of ASTM E96/E96M - 12 Standard Test Methods for Water Vapour Transmission of Materials. In order to gain compliance with the Standard, Humpty's Fall Breaker were requested by Branz that the WVT has to greater than or equal to 90 MN s/g (Mega Newton seconds per grams). The thickness of the product also has to be a minimum of 250 microns (μm).

Holmes Solutions LP were requested to interpret the results of permeance testing completed on two different safety mesh materials. The first product is sourced from Japan and was tested by the manufacturer - HAGIHARA. The second product is manufactured in Korea and was independently tested by KOTITI Testing and Research Institute in Korea. The results for each product is present in Table 1.

Table 1 - Test results for WVT as received

Material ID	Water Vapour Transmission test results [g/hm^2]	Thickness [μm]
Japan	1.00	400
Korea	0.11	400

The submitted information for these results are attached at the end of this document. Based on these submitted values, it was requested to convert the units from g/hm^2 (grams per hour per metre squared) to MN s/g (Mega Newton seconds per grams).

According to the information provided by Humpty's Fall Breaker, both tests were performed in accordance with ASTM E96:2005, using the CaCl₂ method, both tests were conducted with temperatures of 38 ± 0.5°C and at 90 ± 2% Relative Humidity.

From the ASTM Standard, the formula for permeance is given as:

$$Permeance = \frac{WVT}{\Delta p} \dots\dots\dots Eq.1$$

$$\Delta p = \text{Vapour pressure difference} = S(R_1 - R_2) \dots\dots\dots Eq.2$$

$$\therefore Permeance = \frac{WVT}{S(R_1 - R_2)} \dots\dots\dots Eq.3$$

Where:

S = Saturation vapour pressure at test temperature.

R₁ = Relative humidity at start the source

R₂ = Relative humidity at the vapour sink

From the relevant tables (Appendix A), the value for S can be found:

S = 6626.4 Pa (Pascals or N/m²)

R₁ = 90%

R₂ = 0 %

It is necessary to convert the given WVT values units from g/hm² to g/sm², in order to accomplish this, it is necessary to divide each value by 3600 secs/hr, this yields new values of WVT as follows:

- Japanese product = 2.78 x 10⁻⁴ g/sm²
- Korean product = 3.05 x 10⁻⁵ g/sm²

From equation 3, we have:

- Japanese Permeance:

$$\frac{WVT}{S(R_1 - R_2)} = \frac{2.78 \times 10^{-4}}{6626.4(90 - 0)} = 4.66 \times 10^{-10} \text{ g / Pa.s.m}^2$$

- Korean Permeance:

$$\frac{WVT}{S(R_1 - R_2)} = \frac{3.05 \times 10^{-5}}{6626.4(90 - 0)} = 5.12 \times 10^{-11} \text{ g / Pa.s.m}^2$$

Now, 1 Pa = 1 N/m², substituting these unit into the answers results in the m² units cancelling each other out, yielding the following permeance units:

$$\frac{\text{g}}{\text{Pa.s.m}^2} = \frac{\text{g}}{\frac{\text{N}}{\text{m}^2} \cdot \text{s.m}^2} = \frac{\text{g}}{\text{N.s}}$$

To present the answer as specified by Branz in the appropriate units of MNs/g, it necessary to take the inverse of the final answer, therefore:

- Japanese product, Permeance = **2146.9 MNs/g > 90 OK**
- Korean product, Permeance = **19517.7 MNs/g > 90 OK**

Regards,



Jason Looij
DESIGN ENGINEER

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APPENDIX A – SATURATION VAPOUR PRESSURE TABLE

Temperature °C.	Metric units									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
0	6.1078	6.1523	6.1971	6.2422	6.2876	6.3333	6.3793	6.4256	6.4721	6.5190
1	6.5662	6.6137	6.6614	6.7095	6.7579	6.8066	6.8556	6.9049	6.9545	7.0044
2	7.0547	7.1053	7.1562	7.2074	7.2590	7.3109	7.3631	7.4157	7.4685	7.5218
3	7.5753	7.6291	7.6833	7.7379	7.7928	7.8480	7.9036	7.9595	8.0158	8.0724
4	8.1294	8.1868	8.2445	8.3026	8.3610	8.4198	8.4789	8.5384	8.5983	8.6586
5	8.7192	8.7802	8.8416	8.9033	8.9655	9.0280	9.0909	9.1542	9.2179	9.2820
6	9.3465	9.4114	9.4766	9.5423	9.6083	9.6748	9.7416	9.8089	9.8765	9.9446
7	10.013	10.082	10.151	10.221	10.291	10.362	10.433	10.505	10.577	10.649
8	10.722	10.795	10.869	10.943	11.017	11.092	11.168	11.243	11.320	11.397
9	11.474	11.552	11.630	11.708	11.787	11.867	11.947	12.027	12.108	12.190
10	12.272	12.355	12.438	12.521	12.606	12.690	12.775	12.860	12.946	13.032
11	13.119	13.207	13.295	13.383	13.472	13.562	13.652	13.742	13.833	13.925
12	14.017	14.110	14.203	14.297	14.391	14.486	14.581	14.678	14.774	14.871
13	14.969	15.067	15.166	15.266	15.365	15.466	15.567	15.669	15.771	15.874
14	15.977	16.081	16.186	16.291	16.397	16.503	16.610	16.718	16.826	16.935
15	17.044	17.154	17.264	17.376	17.487	17.600	17.713	17.827	17.942	18.057
16	18.173	18.290	18.407	18.524	18.643	18.762	18.882	19.002	19.123	19.245
17	19.367	19.490	19.614	19.739	19.864	19.990	20.117	20.244	20.372	20.501
18	20.630	20.760	20.891	21.023	21.155	21.288	21.422	21.556	21.691	21.827
19	21.964	22.101	22.240	22.379	22.518	22.659	22.800	22.942	23.085	23.229
20	23.373	23.518	23.664	23.811	23.959	24.107	24.256	24.406	24.557	24.709
21	24.861	25.014	25.168	25.323	25.479	25.635	25.792	25.950	26.109	26.269
22	26.430	26.592	26.754	26.918	27.082	27.247	27.413	27.580	27.748	27.916
23	28.086	28.256	28.428	28.600	28.773	28.947	29.122	29.298	29.475	29.652
24	29.831	30.011	30.191	30.373	30.555	30.739	30.923	31.109	31.295	31.483
25	31.671	31.860	32.050	32.242	32.434	32.627	32.821	33.016	33.212	33.410
26	33.608	33.807	34.008	34.209	34.411	34.615	34.820	35.025	35.232	35.440
27	35.649	35.859	36.070	36.282	36.495	36.709	36.924	37.140	37.358	37.576
28	37.796	38.017	38.239	38.462	38.686	38.911	39.137	39.365	39.594	39.824
29	40.055	40.287	40.521	40.755	40.991	41.228	41.466	41.705	41.945	42.187
30	42.430	42.674	42.919	43.166	43.414	43.663	43.913	44.165	44.418	44.672
31	44.927	45.184	45.442	45.701	45.961	46.223	46.486	46.750	47.016	47.283
32	47.551	47.820	48.091	48.364	48.637	48.912	49.188	49.466	49.745	50.025
33	50.307	50.590	50.874	51.160	51.447	51.736	52.026	52.317	52.610	52.904
34	53.200	53.497	53.796	54.096	54.397	54.700	55.004	55.310	55.617	55.926
35	56.236	56.548	56.861	57.176	57.492	57.810	58.129	58.450	58.773	59.097
36	59.422	59.749	60.077	60.407	60.739	61.072	61.407	61.743	62.081	62.421
37	62.762	63.105	63.450	63.796	64.144	64.493	64.844	65.196	65.550	65.906
38	66.264	66.623	66.985	67.347	67.712	68.078	68.446	68.815	69.186	69.559
39	69.934	70.310	70.688	71.068	71.450	71.833	72.218	72.605	72.994	73.385
40	73.777	74.171	74.568	74.966	75.365	75.767	76.170	76.575	76.982	77.391
41	77.802	78.215	78.630	79.046	79.465	79.885	80.307	80.731	81.157	81.585
42	82.015	82.447	82.881	83.316	83.754	84.194	84.636	85.079	85.525	85.973
43	86.423	86.875	87.329	87.785	88.243	88.703	89.165	89.629	90.095	90.564
44	91.034	91.507	91.981	92.458	92.937	93.418	93.901	94.386	94.874	95.363
45	95.855	96.349	96.845	97.343	97.844	98.347	98.852	99.359	99.869	100.38
46	100.89	101.41	101.93	102.45	102.97	103.50	104.03	104.56	105.09	105.62
47	106.16	106.70	107.24	107.78	108.33	108.88	109.43	109.98	110.54	111.10
48	111.66	112.22	112.79	113.36	113.93	114.50	115.07	115.65	116.23	116.81
49	117.40	117.99	118.58	119.17	119.77	120.37	120.97	121.57	122.18	122.79
50	123.40	124.01	124.63	125.25	125.87	126.49	127.12	127.75	128.38	129.01

TEST REPORT

KOTITI NO. : 1311005227
APPLICANT : POLYTEX PLASTICS CO., LTD
DATE IN : March 13, 2013
DATE OUT : March 20, 2013

Sample Description	ONE (1) SAMPLE
Item	CLEAR PE TARPAULIN
Buyer	N/S
Style Number	N/S
P.O. Number	N/S
Color(s) Submitted	N/S
Submitted Fiber Composition	N/S
Submitted Care Instruction	N/S
Test Result	For further details, please refer to the following page(s).

* N/S : Not Submitted

PREPARED and CHECKED by :

Sang Rag Lee

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AUTHORIZED by :

Young R. Kim

DR. YOUNG RYUL KIM
DIRECTOR GENERAL – KOTITI

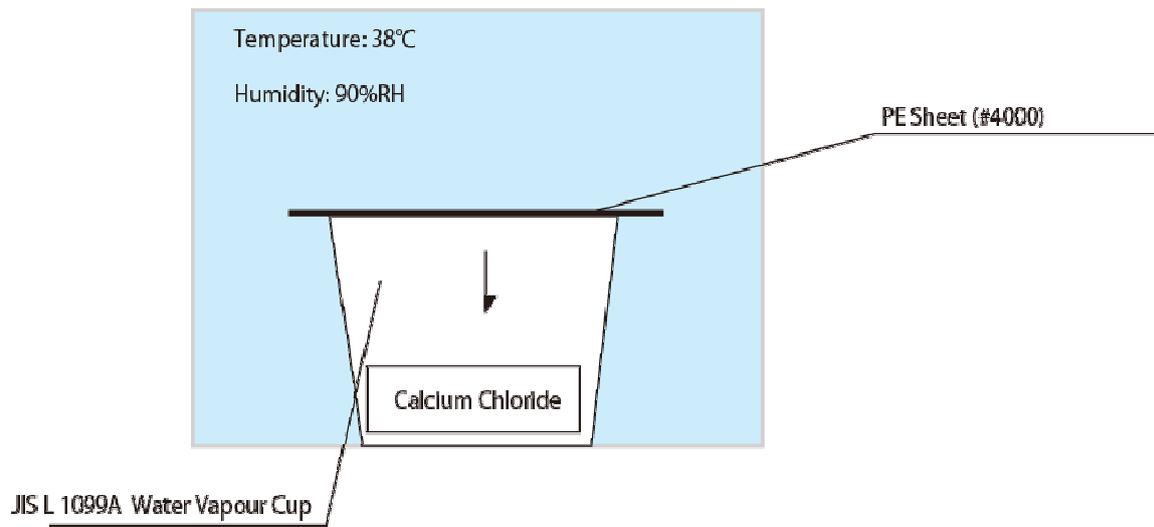
REMARK: SEE ENCLOSED WORKSHEET(S) RESULT

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TEST CONDUCTED	TEST RESULT(S)	TEST METHOD
Water Vapour Transmission, $\text{g/m}^2 \cdot \text{hour}$	0.11	ASTM E 96:2005 (CaCl ₂ Method) (37.8 °C / 90 ± 2% RH)
*Dish Condition – Cup Area: 28.27cm ²		

Sample



- * How much Water Vapour through Calsium Chloride
- * They tested several times, and it just picked avarage no, which is 1g/h/m2.