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August 25, 2010

**To:** **ALL AMERICAN NUDURA CLIENT GROUPS AND DESIGN AND REVIEWING PROFESSIONALS**

**From:** **Keven Rector B. Tech. , Technical Services Manager, NUDURA Corporation**

**RE:** **VAPOR PERMEANCE OF NUDURA™ INSULATED CONCRETE FORMS**

One of the most common questions asked by both design professionals and building officials with respect to ICF construction is whether or not an additional vapor barrier or vapor retarder is required to be applied over the interior surface (or depending upon geographic location – on the exterior) of the NUDURA™ Insulated Concrete Form System.

Under Chapter 2 of the IBC 2009 Code Definitions – a Vapor Retarder is defined into one of three distinct classes as follows:

> **VAPOR RETARDER CLASS.** A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method of ASTM E 96 as follows:
>
> **Class I:** 0.1 perm or less.
>
> **Class II:** 0.1 < perm ≤ 1.0 perm.
>
> **Class III:** 1.0 < perm ≤ 10 perm.

In addition, the clauses of most American Building Codes (including the International Code Family) are structured in such a way that they provide for the fact that plain and reinforced concrete or masonry walls constructed in accordance with the Code (or constructed of materials that are not susceptible to damage from moisture) are not required to have additional vapor retarder materials applied to them. IBC 2009 Section 1405 confirms that vapor barriers in fact are required ONLY to protect (wood or steel) framing members from moisture damage which may occur in more northerly climates of the USA. (as screen shot following from IBC 2009)

**SECTION 1405**
**INSTALLATION OF WALL COVERINGS**

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**1405.3 Vapor retarders.** Class I or II vapor retarders shall be provided on the interior side of frame walls in Zones 5, 6, 7, 8 and Marine 4.

**Exceptions:**

1. Basement walls.
2. Below-grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

**1405.3.1 Class III vapor retarders.** Class III vapor retarders shall be permitted where any one of the conditions in Table 1405.3.1 is met.

For the purpose of this communication, the attached letter of analysis is based on documentation that was produced for NUDURA Corporation testing its EPS foam panel components (using Type II Starex 301-H Bead as manufactured for NUDURA by Cheil Industries in tests performed under contract with Intertek Testing Services /ETL Semko to the specification ASTM E96 with the following results (expressed in metric:

2. Water Vapour Permeance: ASTM E96

Starex SF-301H Cheil Industries

| | Sample #1 | Sample #2 | Sample #3 | Average |
|---|---|---|---|---|
| Thickness (mm) | 25.0 | 25.5 | 25.0 | |
| Surface area ($m^2$) | 0.027 | 0.027 | 0.027 | |
| Duration (h) | 312 | 312 | 312 | |
| Test Temperature (°C) | 23 | 23 | 23 | |
| Relative Humidity (R1-R2)(%) | 53 | 53 | 53 | |
| Saturation Pressure (Pa) | 2810.4 | 2810.4 | 2810.4 | |
| Moisture Gain (g) | 3.94 | 4.13 | 4.88 | |
| WVT ($g/h.m^2$) | 0.468 | 0.490 | 0.579 | |
| Water vapour Permeance ($ng/Pa.s.m^2$) | 87 | 91 | 108 | 95 |
| Requirement | | | | <200ng/Pa.s.$m^2$ @ a thickness of 25 mm |

Based on this testing, and knowing that 1 Perm = the metric equivalent of 57.692 $ng/Pa.s.m^2$ we can therefore calculate that the vapor permeance of 1 inch (or average 25 mm) thickness of NUDURA EPS foam is approximately 95 to 96 $ng/Pa.s.m^2$ .

Based on the above noted test results, the attached communication from Intertek ADDITIONALLY verifies that the calculated vapor permeance of 2 5/8" thickness of NUDURA foam on the interior panel or exterior panel of the concrete wall assembly achieves a MAXIMUM Vapor Permeance of 36 ng/Pa.s.$m^2$ which, using the same conversion rate applied above, verifies that the Permeance Rating of 2 5/8" of NUDURA EPS foam is therefore equal to **0.624 perm** and therefore achieves a resulting vapor permeance performance that qualifies either the interior or exterior EPS panels of NUDURA as a Class II Vapor Barrier under the IBC 2009.

Remember that this rate has been determined independent of any resistance to vapor permeance that the monolithic concrete wall itself provides within the wall assembly.

Any questions with respect to this documentation should be directed to our technical support staff through your local NUDURA distributor.

NUDURA Corporation /Aug. 2010

Intertek ETL SEMKO

January 14, 2005

Keven Rector, B. Tech.
Technical Services Manager
NUDURA Corporation

**Re: Permeance of EPS @ 2.625" (67 mm)**

Dear Mr. Rector,

Upon your request, Intertek has conducted an engineering review of your existing test data to determine the Permeance of the Nudura 2.625" (67 mm) EPS panel.

From Intertek Report 3025950-1, dated July 18, 2002, it is shown that at 25 mm the Permeance is 96 ng/Pa-s-$m^2$, when tested per ASTM E 96.

| | | |
|---|---|---|
| Per ASTM E 96, equation 3: | Permeability | = Permeance x Thickness |
| so, | Permeance | = Permeability / Thickness |
| where as, | Permeability | = (96 ng/Pa-s-$m^2$) x (25 mm)<br>= 2400 mm-ng/ Pa-s-$m^2$ |
| and @ 67 mm, | Permeance | = (2400 mm-ng/Pa-s-$m^2$) / (67 mm)<br>= 36 ng/Pa-s-$m^2$ |

Therefore, the Permeance of your Nudura 2.625" (67 mm) EPS panel is **36 ng/Pa-s-$m^2$,** when tested and calculated following ASTM E 96. This value is less than the maximum of 45 ng/Pa-s-$m^2$ requirement in Section 9.25.4.2 of the National Building Code of Canada and respective provincial Codes, therefore satisfying the Code requirement.

If you have any questions or concerns regarding this matter, please do not hesitate to contact the undersigned at 1-800-668-TEST.

**INTERTEK TESTING SERVICES NA LTD.**
**Warnock Hersey**

Chris Bowness, P.Eng.
Manager - Construction Products

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