MORRISON HERSHFIELD

September 12, 2016

Ted Cullen
TBC (Canada) Inc.
45016 Rochon Rd.
P.O. Box 577, La Salle, Manitoba
R0G 1B0

Dear Mr. Cullen,

Re: Tested Thermal Performance of 2" Quik-Therm MPI, Connect, Connect Air Dry and Solar Dry Systems

We have been provided with three thermal performance test reports, each authored by Architectural Testing Inc. of St. Paul Minnesota. These documents report on the results of testing to ASTM C1363-05 *Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.*

We discuss the three test reports below:

Test "A" - ATI Report No. 92001.01-201-46

Product: Wood Wall Assembly #8
Report date: 08/27/09

This test was performed on "Wood Wall Assembly #8". As per the test report, ATI tested a 72" x 96" sample of a wall consisting of:

- 2" Quik-Therm (sold as "Quik-Therm Multi-Purpose Insulation (MPI)" and "Connect");
- 7/16" OSB sheathing;
- 2x4 wood studs with no insulation;
- ½" interior gypsum wallboard.

The tested performance of the wall system was:

- Thermal transmittance (U) = 0.074 BTU/(hr·ft^2·°F)
- Effective thermal resistance (Rc) without air films = 12.30 (hr·ft^2·°F)/BTU
  = 2.16 (m^2·°C)/W
- Effective thermal resistance (Ru) with air films = 13.43 (hr·ft^2·°F)/BTU
  = 2.36 (m^2·°C)/W

Test "B" - ATI Report No. B2154.01-201-46

Product: 2" Quik-Therm Connect with Empty Cavity and Cement Board Siding
Report date: 09/19/11

This test was performed on "2" Quik-Therm Connect with Empty Cavity and Cement Board Siding". As per the test report, ATI tested a 72" x 82-1/2" sample of a wall consisting of:

- ¼" cement board siding;
- 2" Quik-Therm Connect panel with flutes (sold as "Solar Dry") with flutes facing inward to sheathing
- 7/16" OSB sheathing;
- 2x4 wood studs (empty cavity);
- 6 mil poly vapour barrier;
- 3/8" gypsum wall board.

The tested performance of the wall system was:

- Thermal transmittance (U) = 0.08 BTU/(hr·ft²·°F)
- Effective thermal resistance (Rs) without air films = 12.33 (hr·ft²·°F)/BTU
  = 2.17 (m²·°C)/W
- Effective thermal resistance (Ru) with air films = 13.17 (hr·ft²·°F)/BTU
  = 2.32 (m²·°C)/W

Test "C" - ATI Report No. B2656.01-201-46

Product: 2" Quik-Therm Connect with R13 Batts and Cement Board Siding
Report date: 09/19/11

This test was performed on "2" Quik-Therm Connect with R13 Batts and Cement Board Siding". As per the test report, ATI tested a 72" x 82-3/8" sample of a wall consisting of:

- ¼" cement board siding;
- Quik-Therm (sold as "Quik-Therm Multi-Purpose Insulation (MPI)" and "Connect")
- 7/16" OSB sheathing;
- 2x4 wood studs with R13 batts;
- 6 mil poly vapour barrier;
- 3/8" gypsum wall board.

The tested performance of the wall system was:

- Thermal transmittance (U) = 0.04 BTU/(hr·ft²·°F)
- Effective thermal resistance (Rc) without air films = 22.18 (hr·ft²·°F)/BTU
  = 3.90 (m²·°C)/W
- Effective thermal resistance (Ru) with air films = 23.11 (hr·ft²·°F)/BTU
  = 4.07 (m²·°C)/W

Comments

ATI is a well-recognized and certified laboratory to carry out thermal testing including ASTM C1363-05. ASTM C1363-05 is the appropriate test method to evaluate the thermal performance (U or R value) of a wall system, and the boundary conditions used in the testing conform to ASTM C1363-05.

It is appropriate to use the tested thermal resistance to determine compliance with ASHRAE 90.1 or minimum thermal resistance requirements in Canadian building codes for the wall system as described as long as each layer is at least as thick as listed above.

Findings

Table 1 compares the Nominal Insulation requirements of the Manitoba Building Code with the Effective R-value from wood frame walls using the methods defined by ASHRAE 90.1 and with the tested performance of wall systems using Quik-Therm exterior insulation systems. We note that the values listed in ASHRAE Table A3.4 are based on laboratory testing of framed wall assemblies, and therefore comparison between these values and those obtained in the ASTM C1363-05 is reasonable.

Table 1 Summary of Performance Requirements	South of 53 parallel	North of 53 parallel
Nominal(1) Rvalue Requirement for Manitoba	R 20	R 25
Calculated(2) **Effective** Rvalue of 2x6 wall with R 20 Batt as per ASHRAE 90.1	R 15.4	R 20.4 (with R5 outside)
Tested(3) **Effective** Rvalue of 2x4 wall with batt and 2" Quik-Therm	R 22.1	
Estimated(4) **Effective** RValue of 2x6 wall with batt and 2" Quik-Therm	R 28.3	

Notes

(1) Table 9.25.6.2 of the Manitoba Building Code (MBC) requires a nominal R-value of R 20 (RSI-3.5) for buildings located south of the 53rd Parallel and R 25 (RSI-4.4) north of the 53rd Parallel.

(2) ASHRAE 90.1 Table A3.4 gives an effective R-value of R 15.4 (RSI-2.71) for a wall with 2"x6" wood framing spaced at 16" on centre and R 20 (RSI-3.5) cavity insulation. With an additional R 5 continuous insulation outboard, the table gives R 20.4

(3) ASTM C1363-05 Test C, above, was carried out on a wall with a typical US batt (R-13) and achieved R 23.1. Typical Canadian batts are R12. We have conservatively de-rated result by the full R 1.

(4) Conservatively estimated by adding 75% (15/20) of the difference between R 20 batt and tested R 13 batt to the ASTM C1363-05 Test C result.

Quik-Therm is effectively impermeable and when installed as tested it is subject to the requirements of Article 9.25.5.2. **Position of Low Permeance Materials,** and Table 9.25.5.2 that defines the "Minimum Ratio of Total Thermal Resistance Outboard of Material's Inner Surface to Total Thermal Resistance Inboard of Material's Inner Surface" for different climates defined by degree-days. The calculation, detailed in Appendix A-9.25.5.2., is based on nominal R-values for all materials and air films.

Table 2 Compliance with 9.25.5.2	Ratio of Outboard to Inboard Thermal Resistance[5]	Limit for number of Heating Degree Days as per Table 9.25.5.2
2x4 wall with batt and 2" Quik-Therm	0.65	11,999 HDD
2x6 wall with batt and 2" Quik-Therm	0.40	7,999 HDD

Notes

(5) These ratios were calculated as per the method outlined in Appendix A-9.25.5.2.

Analysis

The significance of ATI Tests A and B is that comparing their results confirms that the presence of the shallow flutes of the "Solar Dry" does not significantly affect the thermal resistance of the assembly when compared to the assembly containing "Quik-Therm" insulation. Similar conclusions can be applied to the flutes in the "Connect Air Dry" system.

Taking into account tested thermal performance and the requirements of National Buidling Code (NBC) Table 9.25.5.2, we conclude that the 2" Quik-Therm Connect system as described in Test "C" is an alternative solution to achieve equivalent or better performance than the requirements in MBC Table 9.25.6.2 for above grade walls in all areas of Manitoba.

Using 2" Quik-Therm MPI, Solar Dry, Connect, or Connect Air Dry on the outboard side of a 2"x6" framed stud assembly, with R 20 fibreglass batt insulation in the stud space and a vapour barrier installed on the warm side of the batt insulation, would also meet the requirements of NBC Table 9.25.5.2 for all locations with heating degree days under 8,000. We also note the following:

- The Quik-Therm Connect system provides a continuous layer of exterior insulation, which will reduce the effects of thermal bridging at stud locations.
- As noted in the attached letters authoured by Robin Wynd, P.Eng. and Michael Dietrich, P.Eng., dated September 20, 2011 and May 1, 2012, the Quik Therm T&G Connect system can be used in conjunction with stucco and cement fibre board cladding if installed in a manner consistent with the listed assumptions.

Yours truly,
Morrison Hershfield Limited

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