

Single Wythe Masonry Walls and Air Barriers

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Okay, so you are totally confused about air barriers whether you are an architect, engineer, mason or building owner, and all you want to know is: “Can I construct my building using single wythe masonry and meet code requirements for air infiltration and vapor barrier requirements? The answer is YES. This article aims to demonstrate “how to” in simple terms for the laymen among us all.

In Massachusetts, there is an exception to the vapor barrier requirement of a 0.1 perm vapor barrier, known as Exception #3. This exception allows the designer to use a program such as WUFI, a Department of Energy-sanctioned program used in calculating moisture accumulation in building materials and building assemblies. Using this program can provide a designer a building assembly that does not necessarily include a vapor barrier. Insulation values required by the tables in the code can be traded off using “Comcheck-EZ” software between envelope components, for example, putting all the insulation in the roof and none in the walls. Two computer models were run using WUFI Pro 3.3 software; this computer program determines the flow of water vapor through building materials and measures drying or wetting rates of those materials using weather conditions over a 365-day period.

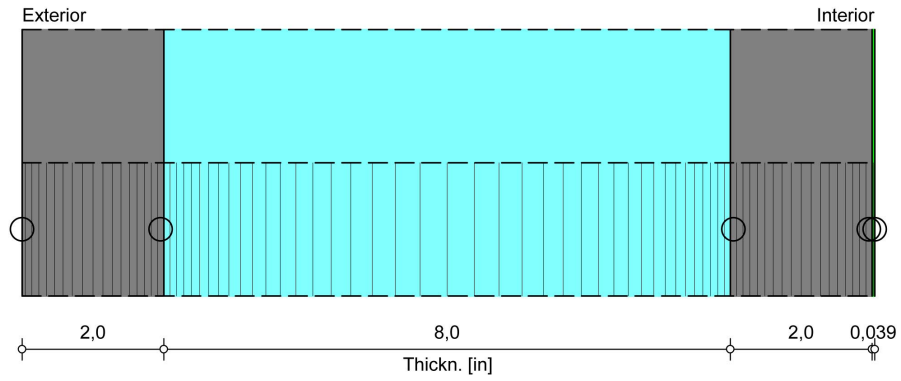
In this case a single wythe 12 inch masonry building in Boston was modeled under two conditions 35% and 50% Relative Humidity.

The 35% RH MODEL for the SINGLE WYHTE WALL

The first model was a building operating at an interior relative humidity of 35% in the winter, the second model was run at 50%, which is a higher relative humidity than most building types. Both models assumed four walls of single wythe with few doors or windows, similar to a big box retail building or large institutional structure. All building materials were assumed to start out at a standard 80% initial moisture content. Why? The 80% moisture content is the safe maximum level of moisture content in building products; when they go above or retain 80% RH they begin to degrade, corrode, support mold growth; so above 80% is when “bad things begin to happen”. As you view some of the WUFI computer data, above 80% moisture content (of all monitoring points) is considered an unacceptable level. Monitors were placed in five locations to measure moisture infiltration and drying rates on the single wythe block, they are: Exterior face, Interior of exterior face, the Exterior of the interior face, Beneath the coating system (interior) and on Top of the coating system (interior) as follows:





COMPONENT ASSEMBLY

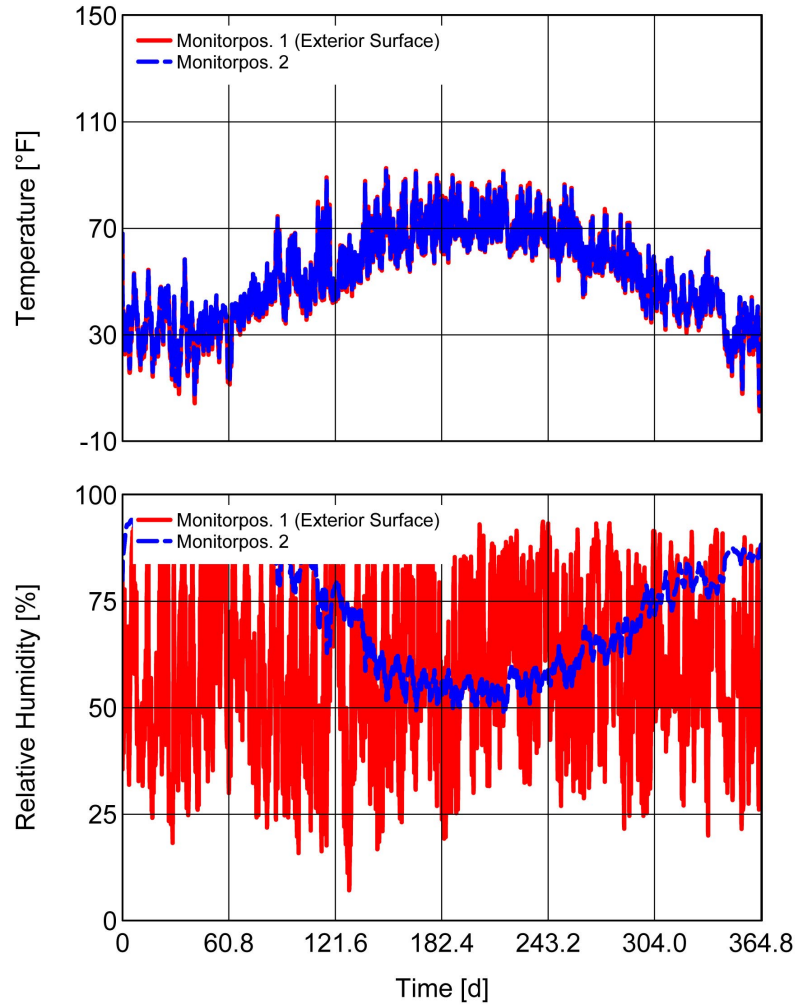
Case: Inside Coating 35% RH

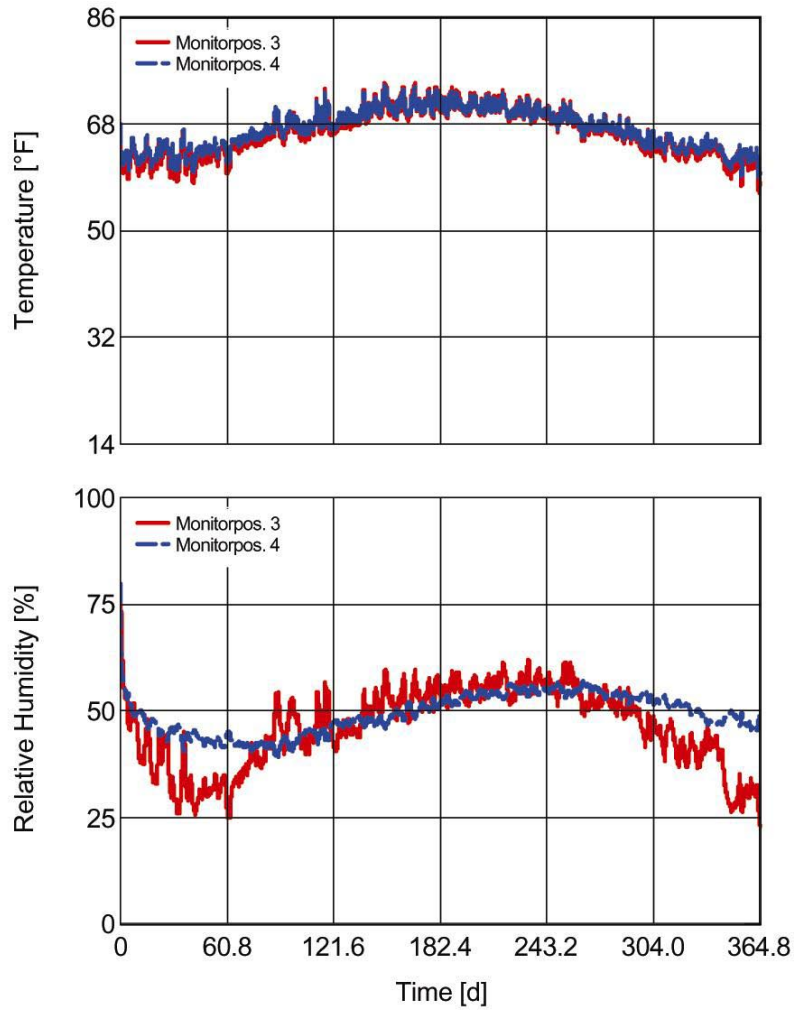


○ - Monitor positions

Materials :

-  - Concrete Block
-  - Air Layer
-  - Concrete, B1
-  - TNEMEC Envirocrete Series 156





Project: TNEVEC Envirocrete 156 AB / Case 1: Inside Coating 35% RH

Figure 1 and 3 Show temperature of monitor points over one (1) year period, 365 days
 Figure 2 and 4 Show Moisture wet/dry of block over one (1) year period, block starts out wet over 80%, but decreases in moisture throughout the year, this effect decreases lower when model is run out over two years. The inner monitor points, 3 and 4 are well below the 80%.

The 35% interior operating RH model used Boston weather with a north facing wall, two coats of TNEMEC 156 AB ENVIROCRETE Air Barrier coating was roller applied to the *interior* face of the block in two coats at a film thickness of 8.0 to 10.0 mils per coat, with a TNEMEC PRIMAPELL H2O clear, a clear water repellent (Dry-Blok instead of the water repellent would have worked also or an exterior breathable coating). The single wythe block was a hollow core block with no insulation. The TNEMEC 156 AB ENVIROCRETE **passed** with all significant monitoring points showing moisture content relative humidity lower than 80%. This analysis satisfies “Exception # 3 “ for the vapor barrier requirements in Chapter 13 of the Massachusetts code. (see footnote for code data)

35% RH System Recap- Concrete Block 12” ,**Uninsulated**

Coating System-Interior- Two coats of TNEMEC156 AB ENVIROCRETE applied to interior block wall at 8.0 to 10.0 mils DFT per coat

Exterior – Apply one coat TNEMEC PRIMAPELLH2O Exterior Block at 125 to 150 square feet for all exterior wall surfaces or TNEME-CRETE Exterior masonry coating.

The 50% RH MODEL for the SINGLE WYTHE BUILDING

Was run using Urethane foam and Korfil insulation, the use of insulation would be another way of meeting “R” values if the insulation was not used fully at the roof assembly . Both of the following WUFI 3.3 Models assume the same weather conditions as the 35 % RH models and are run over a one year period.





COMPONENT ASSEMBLY

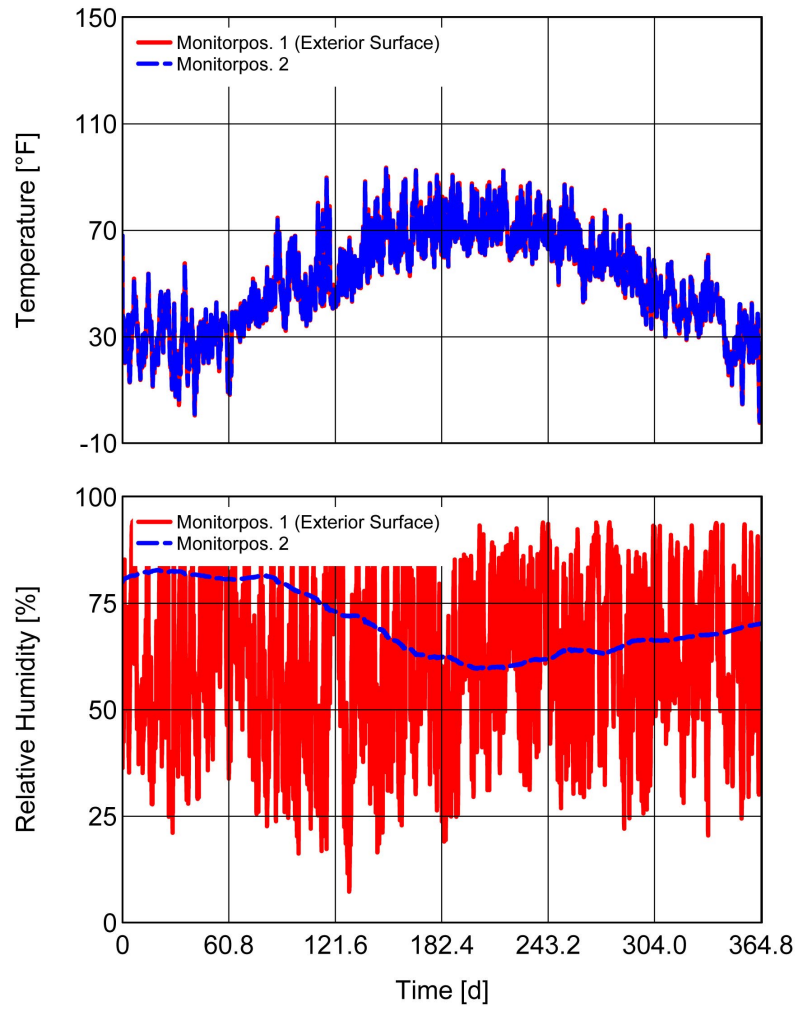
Case: Urethane foam core 50% RH

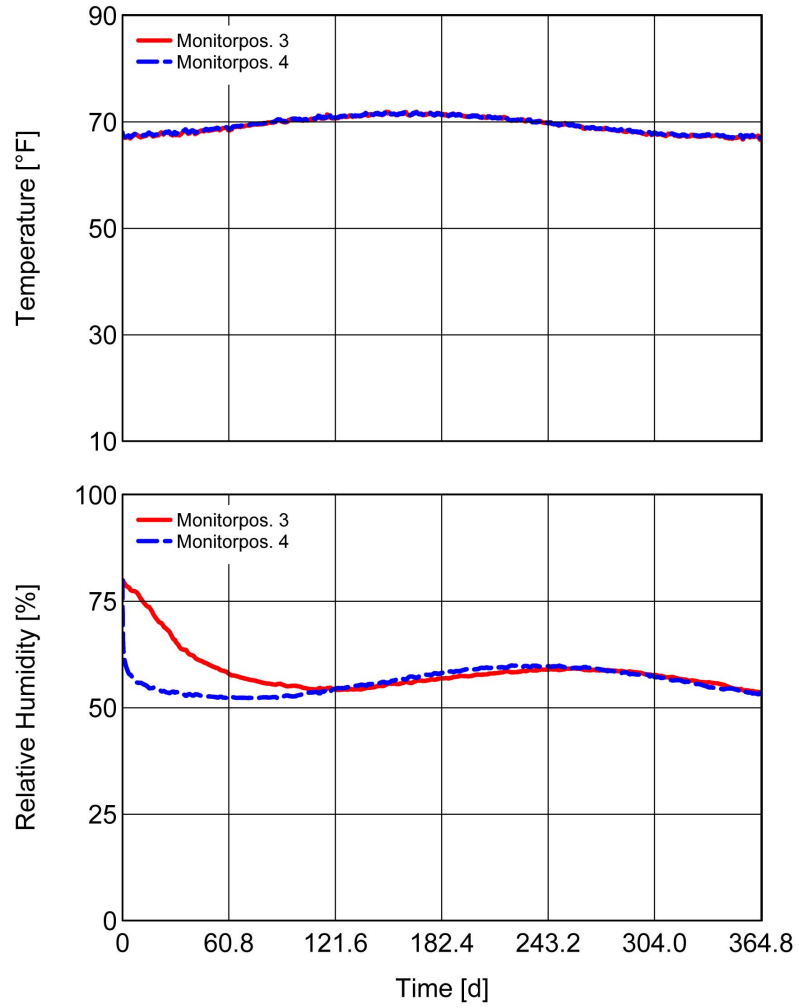


○ - Monitor positions

Materials :

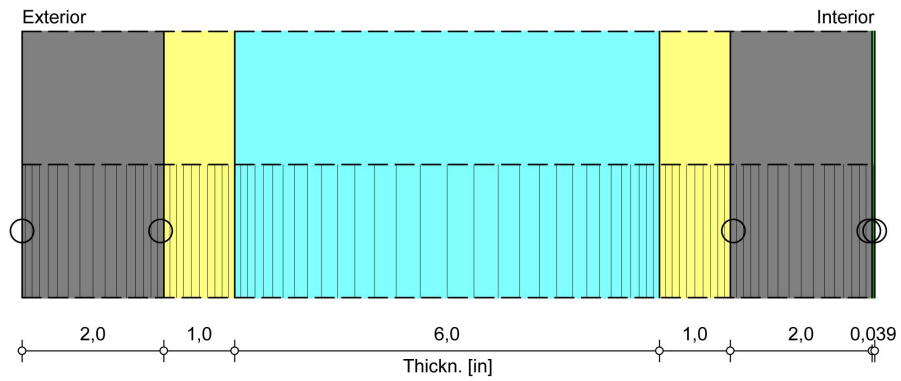
-  - Concrete Block
-  - PU (heat cond.: 0,03 W/mK)
-  - Concrete, B1
-  - TNEMEC Envirocrete Series 156






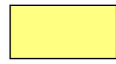




COMPONENT ASSEMBLY

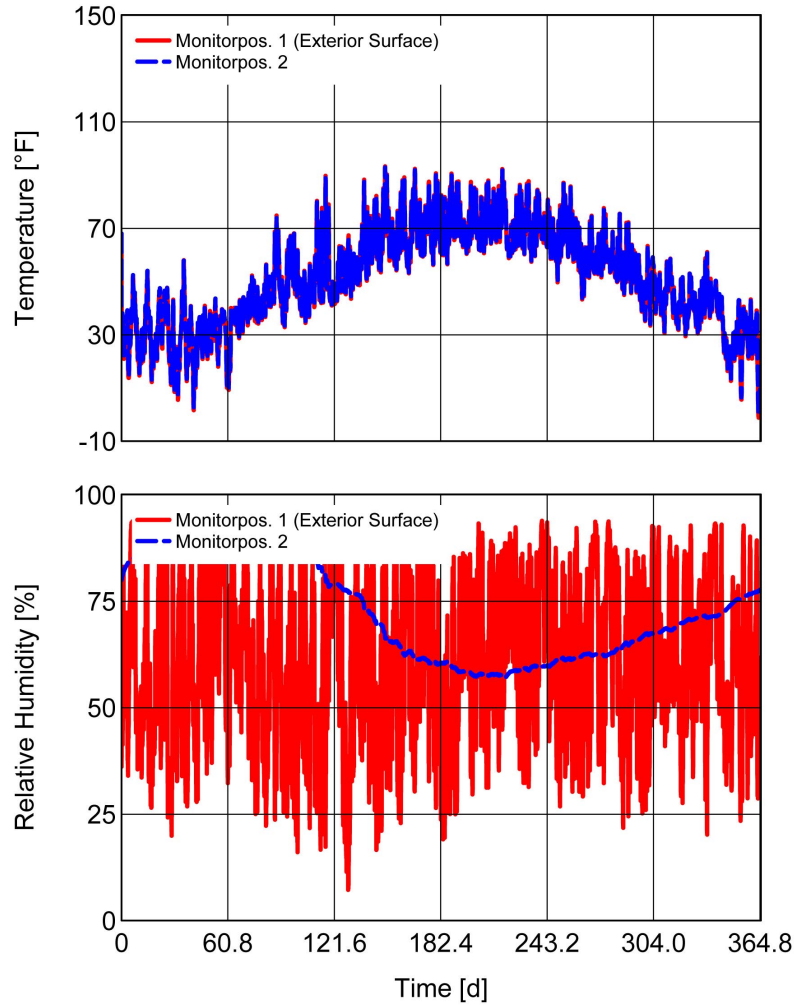
Case: Korfil Core



○ - Monitor positions

Materials :

-  - Concrete Block
-  - Expanded Polystyrene
-  - Air Layer
-  - Expanded Polystyrene
-  - Concrete, B1
-  - TNEMEC Envirocrete Series 156



Project: TNEMEC Envirocrete 156 AB / Case 9: Korfil Core

Note: Notice in both insulated core filled models that moisture content never rises above 80% RH after initial construction of the block. All other monitoring points stay below the 80%, as the building dries out after construction moisture content will continue to fall.

The 50% RH model had the same Boston weather, but with foamed in place urethane or Korfil inserted insulation. TNEMEC 156 ENVIROCRETE AB flexible air barrier coating and paint finish was roller applied to the *interior* face of the block at 8.0 to 10.0 mils DFT per coat, with the same PRIMAPELL H2O clear sealer applied to the exterior (again Dry-Blok works too, instead of the water repellent). The results were the same as the 35% model, no increase of moisture content above the *80% level*.

Conclusions of both models– Based upon the WUFI MODELS of 35% and 50 % interior operating RH, the use of an *interior* air barrier addresses the single wythe block wall for a majority of building types. The implementation of the TNEMEC 156 AB roller-applied (low VOC, water-borne) air barrier would solve numerous design and construction issues that have been raised regarding the use of single wythe block as a building material with respect to meeting air barrier and vapor barrier building code requirements.

Air barriers, including roller-applied should still be applied by an Air Barrier Association of America (ABAA)-certified installer since the coating film needs to be void free and applied at a specific thickness. Details of exterior flashing tying the roofing to the air barrier are noted herein (see detailed drawing). Details for construction should be refined for your buildings specific needs , these details reveal several methods for dealing with the issue of creating a continuous air barrier utilizing membrane , steel ,concrete and bond beam as the most efficient and cost affective approach.

So the answer is YES , one can in fact meet building energy code requirements using single wythe construction in combination with a number of design and modeling techniques.

References:

Air Barrier Association of America, <http://www.airbarrier.org>
WUFI Pro 3.3 Computer Air Barrier modeling