# THERMAFIBER® RAINBARRIER® CI INSULATION

## Moisture Performance

### Scope Statement

When installed in above-grade exterior wall applications, mineral wool continuous insulation (ci) is uniquely suited to deliver unmatched fire resistance while also managing vapor and liquid moisture. This bulletin describes three moisture benefits of mineral wool ci and how they enable substantial design flexibility across many construction types and climate zones.

### Three Moisture Benefits of Mineral Wool CI

**1. Mineral wool ci is vapor permeable**

When vapor or moisture-laden air comes in contact with a cold surface it can condense, (i.e., convert from a gas to a liquid). Of course, if condensation occurs on a glass of ice water, it's fairly harmless. However, if condensation occurs within an exterior wall assembly, the consequences could be far more severe. It may lead to mold, mildew, or even structural damage. Fortunately, assemblies can be designed in such a way that vapor can exit the wall before it becomes problematic.

Managing vapor flow keeps moisture from collecting on cooler surfaces, such as the back side of exterior sheathing or interior drywall or becoming trapped inside the assembly. At roughly 50 perms (per ASTM E96[ii]) Thermafiber® RainBarrier® mineral wool ci provides a high level of vapor permeance.

In contrast, some foam plastic insulations (e.g., foil-faced polyisocyanurate) have substantially lower perm ratings and are classified by building codes as Class 1 vapor retarders (0-0.1 perms). Materials meeting Class 1 are often referred to as vapor "barriers" because they are considered vapor impermeable. In most applications, it is important to avoid installing vapor barriers on both sides of the wall assembly (a.k.a. "double vapor barriers") which can trap moisture and reduce the ability of the wall to dry in at least one direction.

Regardless of the climate zone, permeable mineral wool ci, combined with appropriate air barriers and vapor retarders, offers significant design flexibility to AEC professionals while virtually eliminating the possibility of creating a double vapor barrier assembly. See Figures 1, 2, and 3.

### MINERAL WOOL CI ALLOWS FOR MAXIMUM DESIGN FLEXIBILITY

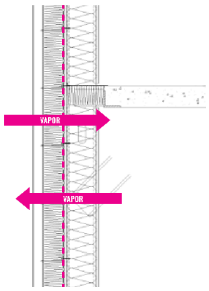


**Figure 1:** Vapor permeable wall assembly with mineral wool ci and vapor permeable air and water barrier system.

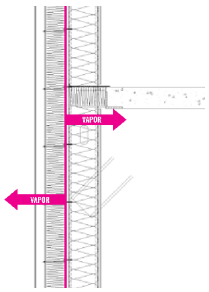


**Figure 2:** Vapor impermeable wall assembly with mineral wool ci and vapor impermeable air and water barrier system.

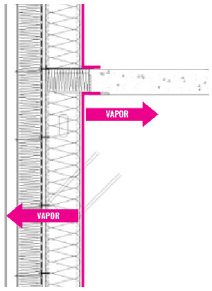


**Figure 3:** Vapor impermeable wall assembly with mineral wool ci and vapor permeable air and water barrier system and interior vapor retarding membrane.

**2. Mineral wool ci is engineered not to absorb vapor**

According to psychometric chart data, published by ASHRAE*, the higher the temperature, the more moisture the air will hold before condensation occurs. Conversely, cool air cannot hold as much moisture, increasing the risk of condensation. As water is thermally conductive, any moisture in the insulation as temperatures cool will reduce its R-value thermal performance. Therefore, it is important that mineral wool ci be engineered not to absorb water vapor when subjected to high heat and humidity. Thermafiber® RainBarrier® mineral wool has a minimal sorption of just 0.03%, even in harsh, hot, and humid environmental conditions such as those measured by ASTM C1104 (120ºF, 95% humidity for 96 hours). This indicates consistent thermal performance during the service conditions of the thermal insulation. Additionally, the sorption property is consistent throughout the thickness of the mineral wool ci.

*ASHRAE is the American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

**3. Mineral wool is compatible with air and water barriers**

Owens Corning recommends high-quality air and water barriers in all applications, installed according to the manufacturer's recommendations. Options include, but are not limited to, silyl terminated polymers, silicones, acrylics, butyls, bitumens, polyethylenes, and spun-bonded polyolefins.

While ASTM E331 – *Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference* – is not typically performed with insulation in place, Owens Corning completed such an assessment.

Thermafiber® RainBarrier® 45 mineral wool was secured over an STP Air & Water Barrier alongside FOAMULAR® XPS insulation with no difference in performance. See Figures 5, 6, and 7. The test was conducted using assemblies and found:

- No leaks were reported at the 15-minute threshold required to pass code criteria
- No leaks were reported after two hours of excessive, extended exposure

Such testing conditions should be considered extreme as ci should be protected by veneer which was not in place for testing.[vi] Repetitive results in this test demonstrate that the assembly was compatible and fasteners penetrating the mineral wool and air barrier did not cause failure.

### MINERAL WOOL CI WAS INSTALLED OVER AN AIR BARRIER IN AIR AND WATER BARRIER TESTING

**Figure 5:** Partial installation of mineral wool ci over an air and water barrier system

**Figure 6:** Mineral wool ci over an air and water barrier system which was subjected to air and water testing

**Figure 7:** Mineral wool ci over an air and water barrier system undergoing ASTM E331 testing

## Mineral wool is inspiring new material testing suggestions

Traditionally, submersion tests have evaluated the water resistance of insulating materials including polyisocyanurate, expanded polystyrene, and extruded polystyrene. However, there is no consensus on a standard test method, as each product uses a different submersion test to demonstrate water resistant properties.

| | POLYISO | EPS | XPS |
|---|---|---|---|
| ASTM Standard for Product Type | ASTM C1289 | ASTM C578 | ASTM C578 |
| Corresponding Moisture Absorption Test | ASTM C209/ ASTM C1763 | ASTM C272 | ASTM C272 |
| Time Submerged | 2 hours | 24 hours | 24 hours |
| Drain Time | 10 minutes | 0 minutes | 0 minutes |
| "Passing" per Product Standard | 1% maximum* | 2-4% maximum** | 0.03% maximum |

*For Type I, Class 1 and Type 1, Class 2 Polyisocyanurate Products (most common continuous insulations)
**For Types XI, I, VIII, II, & IX Expanded Polystyrene Products (most common continuous insulations

However, while submersion tests may provide some insight into the performance of insulation in applications where sustained moisture is possible (i.e. a flooding horizontal protected membrane plaza decks or foundation applications) they are not relevant for above-grade exterior walls, which are not expected to experience such extreme conditions. In fact, other exterior wall assembly components, such as cladding and exterior gypsum, are not required to be evaluated via submersion testing and many air and weather barrier system disclaimers state, "not intended for use below grade". Instead, membranes resisting such extreme pressures are referred to as "waterproofing" and may be used below grade or in low slope roofing applications based on a series of waterproofing tests. If the weather barrier is not expected to perform in this application, it is unreasonable to expect such performance for an above-grade ci.

Regardless of your continuous insulation choice Owens Corning advocates for consensus-backed testing that adequately and accurately assesses the moisture performance of all continuous insulation types in above grade walls.

## Evaluating mineral wool's thermal performance after sustained moisture exposure

In the absence of relevant test standards, such as a spray rack method, Owens Corning evaluated the thermal resiliency of Thermafiber® RainBarrier® ci using ASTM C518[viii]. The thermal conductivity of the test material was measured before and after being submerged in water for a period of 88 hours. The test samples were removed from the water, allowed to dry, and tested per ASTM C518. The test showed the samples maintained their original thermal conductivity performance.

## Thermafiber® RainBarrier® delivers exceptional all around performance

All performance attributes – fire performance, sustainability, acoustic performance, and vapor permeability – should be considered when selecting a ci product. While mineral wool's reputation for outstanding fire resistance has long captured the market's attention, the three performance attributes described above illustrate mineral wool's hydrophobic properties. The ability to perform in wall cavities where moisture is present makes mineral wool well suited as a ci for exterior wall assemblies.

**For more information, please visit www.owenscorning.com/thermafiber**


I. ASTM C1104 Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation
II. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials
III. https://cdn01.rockwool.com/siteassets/o2-rockwool/documentation/research/research-summary/drainage-balance-testing-and-wall-comparison---research-summary.pdf?f=20190918071302
IV. ASHRAE 160 Criteria for Moisture-Control Design Analysis in Building
V. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
VI. For test summary, please see Results for Steel Stud, Results for Wood Stud, and Results for CMU.
VII. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus


**Purpose**
This technical bulletin is intended as a resource for design professionals, to promote more uniform criteria for plan review and jobsite inspection of projects. This bulletin indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered and adopted.

**Code Compliance**
The information presented is correct to the best of our knowledge at the date of issuance. Because codes continue to evolve, check with a local official prior to design and installation. Other restrictions and exemptions may apply. This is only intended as a quick reference.

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Always follow appropriate safety and industrial hygiene practices during installation. Wear appropriate personal protective equipment. Review SDS and literature before specification and installation.


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