

MAX NO. 9002

SUBJECT: EXPOSURE TO MOISTURE

DATE: JULY 2018 (REVISED JANUARY 2019)


R-Shield® MAX is a graphite polystyrene rigid foam insulation with high R-value and superior moisture resistance. R-Shield MAX is a closed cell foam manufactured to resist moisture absorption in wetting conditions and release absorbed moisture quickly during drying periods.

R-Shield MAX, like all insulation, may be exposed to challenging moisture conditions in building insulation applications. The behavior of any insulation when exposed to moisture is critical to understanding the potential impact of water absorption on the insulation's R-value.

The exposure of insulation to moisture varies widely in the most common building insulation applications:

- Roof insulation is protected by a membrane and is not exposed to rain
- Wall insulation is protected by a weather resistive barrier and is not exposed to rain
- Below Grade insulation installed with ground sloping away from the foundation and drainage at footings experiences little moisture exposure

The insulation industry for years has conducted water absorption testing as a means of quality control. ASTM C578¹ has very specific requirements for testing the water absorption of polystyrene insulation following ASTM C272². The ASTM C272 test method involves placing a 1 in. x 12 in. x 12 in. sample of polystyrene insulation under water for 24 hours. After 24 hours the sample is taken out of the water, surface water on the sample is removed, and a determination of the water absorption by volume is made. The ASTM C578 requirements for this quality control test are as follows:


PRODUCT			
	100	150	250
Water Absorption max., volume %, ASTM C272	4.0	3.0	2.0

Some building industry representatives have long referenced these ASTM C578 short-term quality control test results and inappropriately considered the values as the expected water absorption in building applications.

Researchers from Dow Chemical³ as early as 1983 concluded "that moisture gain in perimeter insulation cannot be predicted accurately by any one laboratory test". More recently, building science professionals rely on complex software, such as WUFI⁴, to attempt to predict the transient heat and moisture transport in buildings.

More useful information on the performance of R-Shield MAX insulation when subjected to the normal wetting and drying conditions of building applications is now available.

R-Shield MAX samples which completed 24 hours of submersion in water in accordance with ASTM C272 testing were stored for an additional 24 hours in 50% RH air immediately upon removal from the water. This additional time period provides critical insight into the full cycle of R-Shield MAX wetting and drying behavior.

PRODUCT			
	100	150	250
Water Absorption max., volume %, ASTM C272 and additional 24 hour in 50% RH air.	< 0.3	< 0.3	< 0.3

The results above from the full cycle of a 24 hour under water exposure followed by a 24 hour air exposure clearly demonstrates R-Shield MAX resists moisture absorption in wetting conditions and releases absorbed moisture quickly during drying periods, which means R-Shield MAX will maintain R-value performance under the most demanding building applications.

- Reference: ¹ ASTM C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation. ASTM.
- ² ASTM C272, Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions. ASTM.
- ³ Laboratory Methods for Determining Moisture Absorption of Thermal Insulations. II: Comparison of Three Water Absorption Test Methods with Field Performance Data. Journal of Thermal Insulation Vol. 7, 128-137. (1983). A.O. Forgues, Dow Chemical Canada Inc.
- ⁴ WUFI®. WUFI is a family of software products that allows realistic calculation of the transient coupled one- and two dimensional heat and moisture transport in walls and other multi-layer building components exposed to natural weather. www.wufi.de/en/