MASTER® BUILDERS SOLUTIONS

Product in Focus

MasterPel®

Water-Repellent Admixture System

for Concrete Masonry Walls

Introduction

Concrete masonry units (CMUs) are one of the most popular and durable building materials used in the construction industry. There is a large variety of unit shapes, styles and colors for architectural design considerations. Whether for commercial, industrial, institutional, or residential construction, CMU designs continue to offer design flexibility, economy and durable performance.

One of the most important considerations in designing concrete masonry walls for exterior use is water-repellency. Water penetration into multi-wythe "cavity" wall or single-wythe CMU wall construction can have a major impact on the performance of a masonry wall. This often leads to moisture-related problems on the interior of the structure.

Several design factors are generally accepted as critical to successfully prevent water intrusion through masonry walls. These include the provision of flashing, weep holes, proper tooling of the mortar joints (concave preferred), and the use of water-repellent admixtures in the CMUs and masonry mortar.

Such designs, along with good construction practices, have been used with great success in preventing water penetration. This bulletin focuses on the importance of water-repellent admixtures in preventing water intrusion through concrete masonry walls.

Wind-Driven Rain

Water-Repellency –
The MasterPel water-repellent admixture system significantly reduces water absorption into concrete. Rain is either deflected away or harmlessly puddles on the surface without permeation.

About Master Builders Solutions

Master Builders Solutions is a leading global manufacturer of concrete admixtures, as well as other sustainable solutions for the construction industry, focussed on delivering its vision: **Inspiring people to build better**. Master Builders Solutions provides value-added technology and market-leading R&D capabilities to improve the performance of construction materials and to enable the reduction of CO_2 emissions in the production of concrete. Founded in 1909, Master Builders Solutions has ca. 1600 employees operating 35 production sites globally, supporting their customers in mastering their building challenges of today – for a decarbonised future.

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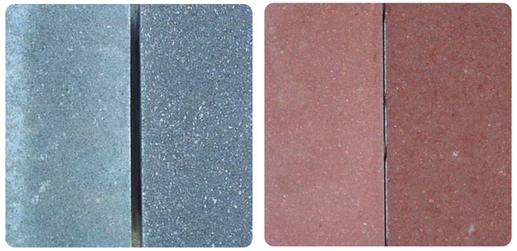
Water-Repellent Admixture Technologies

Water-repellent admixtures lower the absorption and wicking characteristics of both CMUs and masonry mortar, which can significantly reduce or eliminate water penetration through masonry walls. For that reason, Master Builders Solutions' MasterPel water-repellent admixture system is an important part of designing water-repellent concrete masonry walls. The MasterPel water-repellent admixture system offers many benefits to concrete masonry, including:

- Excellent water-repellency characteristics
- Low water absorption
- Resistance to wind-driven rain (per ASTM E 514)
- Advanced efflorescence control
- Long-lasting protection from moisture damage
- Improved texture and visual appeal
- Mold and mildew growth inhibition
- Color vibrancy and longevity

While traditional water-repellent admixture systems may provide similar low absorption or water-repellency properties, the patented MasterPel admixture technology is superior due to its unique chemistry that provides added efflorescence control and superior color vibrancy.



MasterPel 240 admixture-treated CMUs (right in each set) show reduced efflorescence and superior color vibrancy versus traditional water-repellent admixtures.

The MasterPel water-repellent admixture system includes MasterPel 240 water-repellent admixture – a specially formulated polymer emulsion blend that is integrally mixed into CMUs during manufacturing. The system also includes the water-repellent MasterPel 240MA mortar admixture that is added to the masonry mortar during the masonry wall construction, or MasterPel 210E, the powdered water-repellent admixture that is integrated into the mortar during its production. Testing has shown that no other concrete masonry admixture system provides as many benefits as the MasterPel water-repellent admixture system.

Water-Repellency Testing

Constructed Concrete Masonry Walls:

ASTM E 514 – Standard Test Method for Water Penetration and Leakage through Masonry, involves the testing of constructed walls for wind-driven rain resistance [This test method simulates 5.5-inches (140-mm) of rainfall per hour and 62.5- mile (100-km) per hour wind] for a duration up to 72 hours.

ASTM E 514 Wind-Driven Rain Test

	Reference Wall (No Admixture)	Masterpel Admixture Treated Wall
PROJECT # 05-281		
Time to First Dampness (h:min)	0:05	Never
% Dampness @ 72 hours	65%	0%
PROJECT # 03-365		
Time to First Dampness (h:min)	0:25	Never
% Dampness @ 72 hours	3.2%	0%
PROJECT # 97-227		
Time to First Dampness (h:min)	0:35	Never
% Dampness @ 72 hours	41%	0%

ASTM E 514 Testing of CMU wall

Masonry walls with and without BASF MasterPel admixtures were constructed according to ACI 530.1/ASCE 6/TMS 602 and tested according to ASTM E 514, Standard Test Method for Water Penetration and Leakage Through Masonry. The testing was conducted by the National Concrete Masonry Association and extended for 72 hours and rated according to the 1974 version of ASTM E 514.

The reference walls contained no integral water-repellent admixtures, while the admixture-treated walls contained MasterPel 240 admixture in the block and MasterPel 240MA mortar admixture or MasterPel 210E in the masonry mortar. Constructed walls were wrapped in plastic to cure the mortar for 7 days, followed by 14-21 days of ambient lab cure.

The MasterPel water-repellent admixture system achieved an E-Rating, the highest rating, in multiple tests conducted by the National Concrete Masonry Association (NCMA). ASTM E 514 testing results confirm the effectiveness of the MasterPel water-repellent admixture system in improving water-repellent performance. In multiple tests, the back of the MasterPel treated walls stayed dry. For a complete report, please contact your local sales representative. While this test is valid for testing constructed concrete masonry walls, it is not practical for evaluating individual CMUs. Therefore, other standard and non-standard tests on individual CMUs also provide additional performance data on water-repellency characteristics.

Project # 05-281 - Initial Testing MasterPel 240-Treated Wall

Project # 05-281 - After 72 Hours MasterPel 240-Treated Wall

Project # 05-281 - Initial Testing Back of Reference Wall (no admixture)

Project # 05-281 - After 72 Hours Back of Reference Wall (no admixture)

Individual CMUs: Several test methods are available to measure individual CMU water-repellency. These tests can verify and help ensure water-repellent performance before a concrete masonry wall is ever built.

ASTM C 90 – Standard Specification for Loadbearing Concrete Masonry Units, and ASTM C 140 – Standard Test Method for Sampling and Testing Concrete Masonry Units and Related Units are standards that specify a maximum absorption level for CMUs. This maximum level is different for each weight classification listed below.

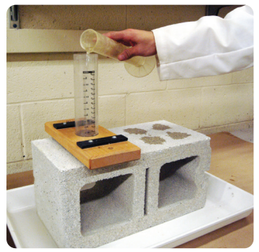
ASTM C 90 - Maximum Absorption Level lb/ft³ (kg/m³)

	Normal	Medium	Lightweight
CMU Weight	>125 (>2000)	105-125 (1680-2000)	<105 (<1680)
Maximum Absorption	13 (208)	15 (240)	18 (288)

Absorption alone is not a good indicator of overall water-repellency. The following non-standard test methods can help demonstrate optimum water-repellency properties:

- Puddle Retention Test – Provides a quick indication of surface repellency in 60 minutes.
- Low-Pressure Permeation Tube Test – Modified RILEM Test Method II.4 uses a calculated wind-driven rain equivalency pressure of 99.3 mph (159.9 kph) to measure water permeation over a 60 minute period.
- Spray-Bar Permeation Test – A measurement of water permeation using 120-gal/h (454-L/h) of continuous water spray simulates a steady rain on a CMU face over a 4 hour period.
- Wicking Resistance – Measures critical capillary water of a CMU over a 24-hour period.

These water-repellency test methods can be used to optimize mix designs, admixture dosages, and water-repellency characteristics for CMU production.



Low pressure permeation and surface puddle retention test

Spray-Bar Tube-test permeation of CMU

CMU Producer Certification Program

BASF's Water-Repellent Admixture Certification Program is designed to help CMU producers manufacture high-performance, water-repellent CMUs on a regular basis. The certification requires stringent testing conducted by NCMA certified technicians in BASF's CCRL (Cement Concrete Reference Laboratories) inspected laboratories. This documented certification program and test data provide architects the confidence they need in specifying water-repellent CMU projects.

Market

Manufactured Concrete Products

Products

- MasterPel 240 Admixture
- MasterPel 240MA
- MasterPel 210E

Summary

Water-repellent concrete masonry continues to be one of the most popular building materials used in today's construction industry. With proper masonry design, good construction practices and the use of the MasterPel water-repellent admixture system, concrete masonry walls will provide years of useful service and protection from water penetration.