More Information

The Master Builders Solutions brand brings all of BASF's expertise together to create chemical solutions for new construction, maintenance, repair and renovation of structures. Master Builders Solutions is built on the experience gained from more than a century in the construction industry.

The know-how and experience of a global community of BASF construction experts form the core of Master Builders Solutions. We combine the right elements from our portfolio to solve your specific construction challenges. We collaborate across areas of expertise and regions and draw on the experience gained from countless construction projects worldwide. We leverage global BASF technologies, as well as our in-depth knowledge of local building needs, to develop innovations that help make you more successful and drive sustainable construction.

The comprehensive portfolio under the Master Builders Solutions brand encompasses concrete admixtures, cement additives, chemical solutions for underground construction, waterproofing solutions, sealants, concrete repair & protection solutions, performance grouts, performance flooring solutions.

*Effective January 1, 2014, the names of BASF's Master Builders Solutions brand products have changed:
Rheopel became MasterPel

Concrete Technology in Focus

Water-Repellent Admixture Certification Program

Performance Optimization, Evaluation and Quality Control

Summary

The Water-Repellent Admixture Certification Program from BASF certifies block producers using MasterPel® high performance admixtures. BASF evaluates the water-repellency properties of block specimens supplied by the producer and, if necessary, makes recommendations for improvements. Once the block specimens meet established stringent water-repellency requirements, the mix design, including admixture dosage, is certified. The water-repellency certification and documentation are valuable tools for producers to acquire specified water-repellent projects. The program will also assist architects in confidently specifying consistent, high performance, water repellent concrete masonry units (CMUs) for specified projects.

Background

CMU-making practices, and materials in particular, can vary from one production facility to the next. Many of these variances are due to aggregate characteristics, including particle size distribution (gradation), particle shape, and absorptivity. As a result, water-repellency is perhaps more affected than any other area of performance. Close attention must be given to each unique set of conditions. Conditions should be optimized prior to the use of the water-repellent admixture. Performance is determined through both ASTM and CSA standards as well as other non-standard testing methods (as described in more detail later in this paper). Once the parameters are determined for a specific mix design, the target criteria for future quality control of CMUs is established. Unfortunately, no practical ASTM standards exist today for identifying the water leakage potential of a masonry unit. Therefore, BASF developed the Water-Repellent Admixture Certification Program.

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Overview

The BASF Water-Repellent Admixture Certification Program, which helps standardize a measurable system for controlling water-repellency, is outlined in five steps:

Step 1. BASF uses computer generated models to help producers optimize mix designs, aggregate gradations, and develop proper admixture dosages

Step 2. BASF works with the producer to develop trial mixes based on the results of Step 1. These trial mixes help determine optimum water-repellency properties

Step 3. Block specimens are evaluated by BASF laboratories for absorption, puddle retention, wicking resistance, and water permeation properties

Step 4. Upon confirmation that the block specimens meet stringent water-repellency requirements, BASF will certify the mix design and admixture dosage and maintain test report documentation. This certification and documentation is a valuable tool for producers to acquire specified water-repellent projects

Step 5. BASF will offer assistance for ongoing quality control support to CMU producers

Step 1: Mix Design and Material Analysis

BASF first obtains all required background information including aggregate gradations and other physical characteristics, material samples (if needed), mix designs, and equipment information. The aggregate proportions are further optimized, if needed, using computer modeling techniques. Next, the ratio of aggregate to cement is evaluated and a water-repellent admixture dosage range is established.

Step 2: Trial Mixing

After recommendations are determined, trial mixes are batched and tested with the assistance of a BASF technical representative. Typically, two or three water-repellent admixture dosages are tried during this process noting their effect on the water-repellent properties, manufacturing process, and overall appearance.

Step 3: Testing/Procedures/Observations

After CMU test batches are fully cured and aged for 7 days, randomly selected blocks are used for water-repellency evaluation at BASF laboratories. The following tests are administered in addition to the standard ASTM C 140 absorption test procedure (Figure 1).

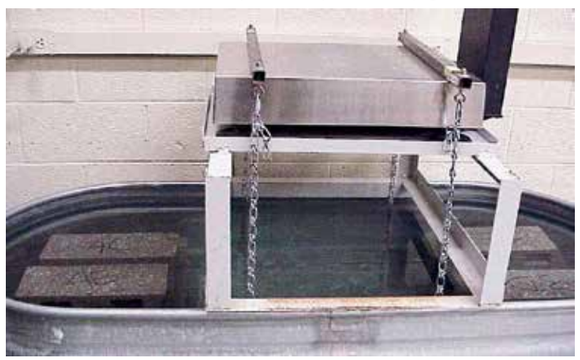

Figure 1: *A standard ASTM C 140 test of the water absorption of CMUs.*

PUDDLE RETENTION

Three blocks are arranged face-up on a level surface and approximately 0.5 fluid ounces (15 mL) of water is placed in three different areas. The water should remain visibly beaded on the block for at least one hour (evaporation is prevented during this period). While this simple procedure does not simulate any natural service conditions, it does provide a quick indication of whether a CMU is sufficiently dense and adequately dosed with the water-repellent admixture.

Note: this simple test can be quickly administered in the field to determine whether or not CMUs contain a water-repellent admixture (Figure 2).

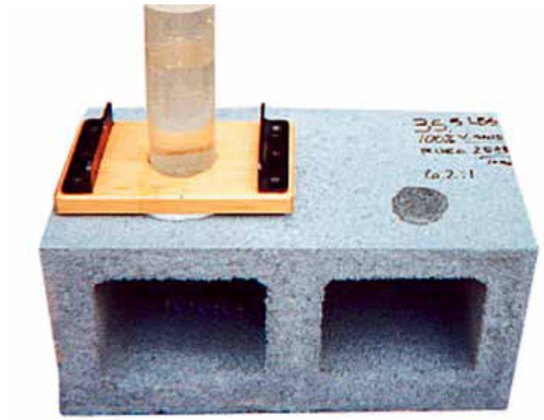

Figure 2: *A low-pressure permeability and puddle retention test. See Chart 1 for equivalent wind-driven rain resistance based on water height reading.*

WICKING RESISTANCE

A block from each batch that successfully met the puddle retention criteria is randomly selected. The block, with core holes up, is placed in a shallow pan of water, and partially submerged 1-2 in. (2.5-5 cm) for 24 hours (Figure 3). The average height of capillary rise (distance between water surface and the dampened area on block) is measured to the nearest 1 mm (avg. 6-8 readings, except for split face surfaces). For normal weight CMUs, this is typically under 1 in. (2.5 cm). This test is critical in determining moisture transmitting potential of the concrete when treated with a water-repellent admixture.

WATER PERMEABILITY TESTING

A. BASF Low-Pressure Permeation Test: (alternate method for RILEM II.4)

Results of low-pressure permeability testing is a function of flow vs. time and a calculated pressure which is translated into an estimated wind-driven rain resistance equivalent (Figure 2 and Chart 1). This is a revealing test, although it has no specific pass/fail criteria. It is a practical tool for determining the optimal performance attainable for a given set of materials.

A representative sample CMU is faced horizontally (up) in a pan. The graduated cylinder (open at both ends with the "0" mark of the graduation on bottom) is positioned over the core area. A rolled strand of soft putty is positioned around the base of the cylinder with finger pressure to seal the perimeter. The hold-down plate is then slid over the cylinder until it contacts the putty. Uniform hand-pressure is applied to create a final seal (use brackets or "C" clamps if necessary). Water is poured into the cylinder, filled to the 5 in. (13 cm) mark and time is immediately recorded. Water level is then recorded at 15, 30, 45, and 60 minutes. A water height of 5 in. (13 cm) is equivalent to a calculated wind-driven rain force of nearly 100 mph (160 kph). While the hydrostatic pressure levels of the RILEM II.4 or low-pressure permeability test procedures can estimate the sustained wind-driven rain conditions of ASTM E 514, there is no direct correlation between the measured results due to substantial variations in the methods themselves. MasterPel admixtures for concrete block and mortar achieved E-Rated (excellent) performance when tested in accordance with ASTM E 514, with a 72-hour test duration and 0% dampness on interior wall surface. *National Concrete Masonry Association (NCMA), MasterPel Reports #97-227 & #03-365.*

B. BASF Spray-Bar, Water Permeation Test

This method simulates a steady rain over the face of a CMU. A representative sample is placed over a pan of water and a spray-bar apparatus is set atop the specimen (Figure 4). This spray bar is a 1/2 in. (12.5 mm) diameter tubing that is 12 in. (300 mm) in length with end caps and has 1/8 in. (3 mm) drilled holes. Water is sprayed on a block face at a rate of 120 gallons per hour (454 Lph). The block is inspected at 1, 2, 3, and 4 hours for any dampness penetrating the block face.

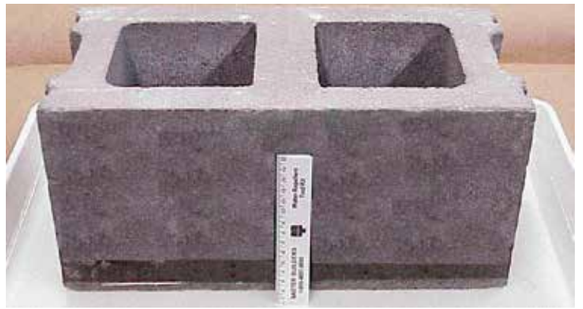

Figure 3: *A wicking resistance test measures the moisture transmitted through a CMU.*

Figure 4: *A spray-bar water permeation test simulates a constant rainfall over a CMU surface and measures water penetration.*

Step 4: Documentation/Certification

All test data is reviewed and documented at the BASF laboratories in Cleveland, Ohio. Once successful results are obtained, qualified admixture dosage(s), performance data, quality control recommendations, and certification(s) are then issued to the block producer per mix design. This information may be used for quality assurance purposes where required for specification submittals.

Step 5: Ongoing Quality Control

The Water-Repellent Admixture Certification Program is an important tool in a producer's ongoing quality control process to consistently produce high performance water-repellent CMUs. It is the producer's responsibility to verify that certification criteria are controlled on each batch run. Therefore, after certification of a given mix and dosage, producers should conduct similar tests to those outlined in this program on an on-going basis to verify CMU certification compliance. Water permeability, puddle retention, and wicking resistance tests can usually be performed right at the plant. Testing is especially important whenever there are changes to the manufacturing process, materials, etc.

Final Notes

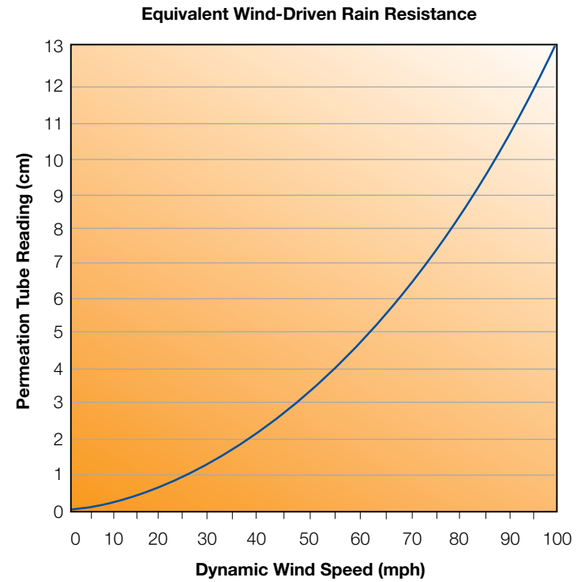

Chart 1: *ASTM E 514 Equivalent Wind-Driven Rain Resistance (based on calculated pressures)*

Because of many production variables outside BASF's control, BASF makes no warranty or guarantee regarding the performance of any producers' CMUs.

Water-repellency test kits with detailed instructions are available through your local sales representative. These kits are a great quality control tool to help measure water-repellency consistency.

BASF also recommends that producers acquire recertification on a regular basis.