



PENETRON INDUSTRY NEWSLETTER

April 2015

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Welcome to the 30th edition of the PENETRON Industry Newsletter.

In our [previous concrete durability update](#), we highlighted how PENETRON ADMIX increases the service life of concrete structures in critical environments by 60 years and more. This life-extension capacity was established by means of the treated concrete's chloride diffusion coefficient and the 2nd Fick law. [\(read here\)](#)

In this issue, we will expand on another aspect of concrete durability -- its ability to resist sulfate attack. Extensive testing has shown that concrete treated with PENETRON ADMIX is virtually resistant to sulfate attack.

Further, we discuss how concrete durability should be tested. Too often, traditional testing methods (such as surface water absorption testing) are being used to test advanced hydrophilic protection systems, which leads to the wrong conclusions. Permeability testing is the only way to verify a true PRAH's (Permeability Reducing Admixture for Hydrostatic conditions) performance.

Last but not least, we invite you to have a look at some recent PENETRON projects in Norway, USA, Saudi Arabia and the UAE.

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PENETRON ADMIX durability research: Resistance to sulfate attack

Sulfate attack typically occurs where water containing dissolved sulfate penetrates the concrete. The ensuing reaction causes the composition and microstructure of the concrete to change. These changes include extensive cracking and loss of bond between the cement paste and aggregate, which in turn cause an internal expansive force.

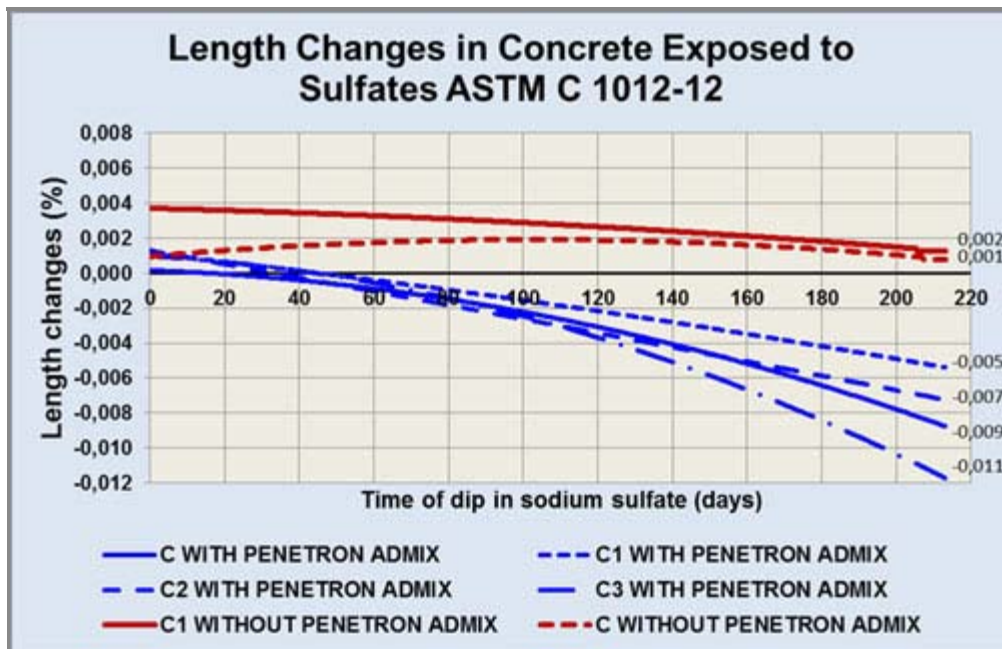


Figure 14. Changes in length of concrete exposed to sulfate, according to ASTM C1012.

Extensive testing has shown that concrete treated with PENETRON ADMIX, subjected to a solution of sodium sulfate, does not show any change in length by such expansion. Untreated concrete samples subjected to the same sodium sulfate solution showed significant change in length as well as disintegration of mass.

PRAN vs PRAH / absorption versus permeability

It is a common and risky misconception in many construction markets today, that capillary absorption tests are suitable to demonstrate the performance of permeability-reducing admixtures for hydrostatic pressure (PRAH).

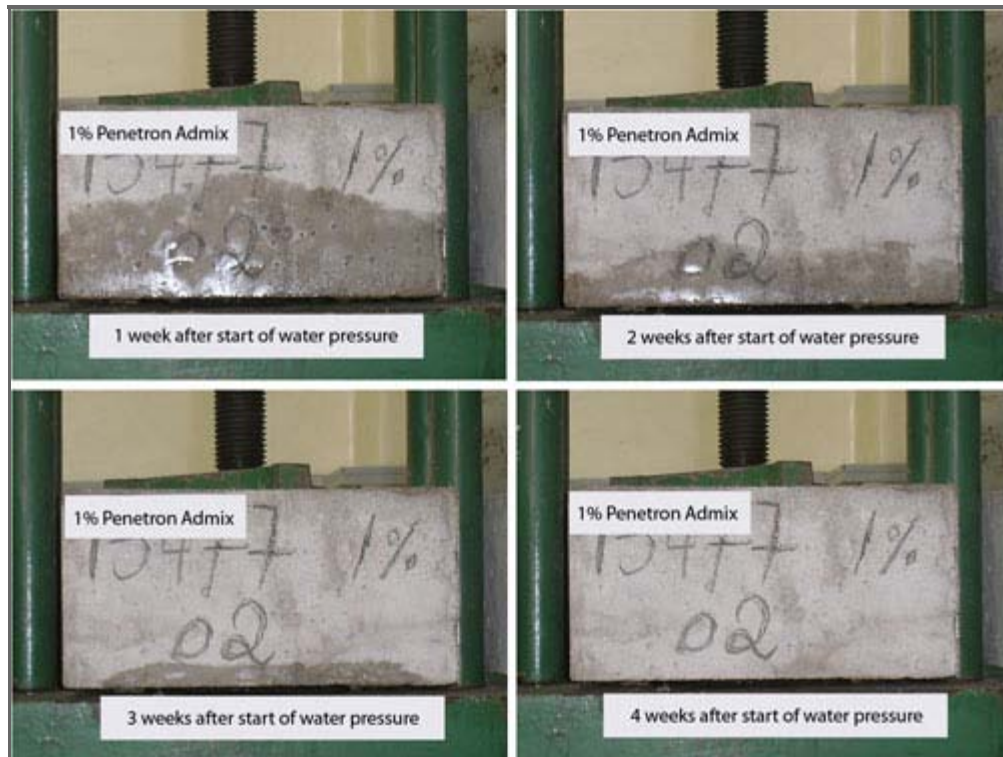
Integral waterproofing admixtures are designed to reduce water ingress into concrete by reducing the permeability of concrete. Hence, the American concrete Institute (ACI) has classified a new category of concrete admixtures called "Permeability-Reducing Admixtures" (PRA), subdivided into "permeability-reducing admixtures for non-hydrostatic conditions" (PRAN) and "permeability-reducing admixtures for hydrostatic conditions" (PRAH).

The ACI 212-3R-10-N report suggests that only crystalline admixtures, like PENETRON ADMIX, qualify as true PRAH. Crystalline admixtures are hydrophilic materials that form insoluble crystalline structures, which seal pores, microcracks and capillaries, reducing concrete permeability even under high hydrostatic pressure.

Hydrophobic or water repellent chemicals such as pore blockers, fall under the category of PRAN. These materials are designed to repel water by blocking pores and capillaries with a water repellent substance. To demonstrate the water-repellent function, manufacturers of hydrophobic admixtures employ capillary absorption tests, such as ASTM C1585 and BS EN 1881-122. These tests measure water absorption after immersion of the sample in water. No pressure is applied, which is why no indication of the level of protection of hydrophobic admixtures exposed to hydrostatic conditions can be established. Due to the uneven coating of the hydrophobic lining and open capillary system, the protection against water under pressure is extremely limited (usually a few centimeters of water head). This limits their use to protection against rain or minimizing dampness.

Crystalline admixtures withstand high, hydrostatic pressure. To determine their performance, only permeability tests such as DIN 1048 pt. 5, BS EN 12390-8 or ASTM D5084 should be used. These tests apply water under pressure and, contrary to absorption tests, are able to give an indication of the performance under hydrostatic conditions. Since a lot of the water applied during this test is taken up by the crystalline reaction to form crystals, a true performance indication can be achieved by repeating the test cycle over several weeks (see 4 week test images below).

To read more on this subject, [click here](#).



Aker Solutions, Stavanger, Norway

Aker Solutions, a global Norwegian company that provides oilfield products and services, recently inaugurated a new office facility in Stavanger. This new building is the global headquarters for the Operations division and home to 2,600 employees. PENETRON ADMIX was used for the extensive below-ground structures for protection from groundwater and seawater at the construction site.

Located adjacent to the North Sea, the Stavanger headquarters features eight above-ground office floors (43,000 m² / 484,400 square feet) and two below-ground floors for a basement with bicycle parking for 1,000 bicycles and a parking garage (65,000 m² / 700,000 square feet) with space for 500 cars.



The site was reclaimed ocean frontage directly on the coastline, exposing the site to the water table and chloride penetration from the seawater. About 11,000m³ of concrete were treated with PENETRON ADMIX, including the building's foundation and basement structures. PENETRON ADMIX was chosen to ensure comprehensive waterproofing and to reduce permeability for chloride ions in the concrete and optimize durability.

PENETRON ADMIX performed flawlessly and allowed construction to proceed without any delays, delivering to the client a completely protected and durable concrete foundation.



Kempinski Hotel Jeddah, Saudi Arabia

The Kempinski Hotel Jeddah is located on Jeddah Corniche providing magnificent views of the Red Sea. Designed to be the first green intelligent hotel in the Kingdom of Saudi Arabia, the 260-meter high tower will boast 321 units: 250 luxury guest rooms and suites, with the rest as serviced apartments spread over 70 floors.



The Kempinski Hotel Jeddah will be the finest address for leisure travelers in Jeddah. The hotel will include a full array of first class facilities including luxurious leisure suites, two restaurants offering a range of international cuisines, a 1000 sqm ballroom, a wellness center and spa, and swimming pool. Corporate guests can take advantage of corporate and meetings facilities, including fully equipped modern meeting rooms, VIP rooms and business suites.

Due to its close proximity to the Red Sea it was imperative to provide a 100% solution when it came to the protection and waterproofing of the raft foundation, retaining walls, and other water-retaining structures such as the water tanks and swimming pools. In order to ensure total concrete protection on this prestigious project. PENETRON ADMIX was added to approximately 30,000m³ of concrete supplied by Saudi Readymix.



Abu Dhabi National Paper Mill (Expansion), Mussafah, UAE

Abu Dhabi National Paper Mill (ADNPM) is one of the largest and most technically advanced producers of jumbo tissue paper rolls in the Middle East. ADNPM follows the highest quality, environmental and health & safety standards including ISO 9001, 14001 and OHSAS 18001. The facility includes manufacturing and storage areas, an effluent treatment plant as well as administration offices and parking. It has a total area of 60,000 square meters and produces over 65,000 tons of tissue paper per year. The paper, produced from the highest-grade virgin pulp, is used to make table napkins, kitchen and hand towels, and facial and toilet tissues.



In 2014 the expansion of the facility saw a new production line (PM3) added to ADNPM.

The building features a 6m deep basement, which is located one meter below the sea water level.

PENETRON ADMIX was tested and chosen as the preferred concrete protection solution and added to the concrete mix of the slab and retaining walls of the new production line facility. All construction joints were sealed using PENEBAR SW 45 waterstop.

PENETRON, PENECRETE MORTAR AND PENEPLUG were employed to treat leaks in the piles.



Manhattan District Garage 1/2/5, New York, USA

Previously located at Pier 52 on the Hudson River, the garage facility was moved to the corner of Spring & West Streets to make waterfront land available for the recently established Hudson River Park. The new Manhattan District 1/2/5 Garage serves the Department of Sanitation New

York (DSNY) as a base of operations for three separate District Garages, as well as the UPS Staging Lot operations for Lower Manhattan.

The Manhattan District 1/2/5 Garage accommodates over 150 sanitation vehicles, a separate vehicle wash, personnel facilities for each district, and centralized fueling and repair facilities. A benchmark project for NYC's Active Design program, the garage features a green roof to protect the building and enhance storm water retention and thermal performance. Designed by Dattner Architects in association with WXY Architecture + Urban Design, the project is set to achieve a LEED Gold certification.

The garage is a five-level structure with a total floor area of about 427,250 square feet (39,700m²). The parking levels, with approximately 266 parking spaces, accommodate vehicle parking and storage, offices, and locker facilities. The building was constructed on a concrete slab with pilings (no cellar) using PENETRON ADMIX SB. In addition, there are two 15,000 L (4,000 gallon) underground tanks, also treated with PENETRON ADMIX, for storage of liquid calcium chloride, which is applied with rock salt to melt snow and ice. Overall, about 12,230m³ (16,000 cubic yards) of concrete were treated with PENETRON ADMIX for all concrete structures.



WITNESS PENETRON'S CRACK HEALING ABILITY

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