Guide For Developing Watertight Concrete

MasterLife® 300 Series Crystalline Capillary Waterproofing Admixtures

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Step 1: Project Requirements

The first step in developing watertight concrete is determining the performance requirements for the project. Generally, these requirements are outlined in the project specification. It is also important to consult with the producer and contractor prior to the project start so that any delivery challenges or desired plastic properties such as workability and setting time are factored into the mixture development.

Step 2: Mix Proportions

In accordance with the recommendations provided in ACI 318, ACI 350, and ACI 212.3R, Master Builders Solutions recommends the use of MasterLife 300 Series admixtures in good quality concrete with a maximum water-cementitious materials ratio of 0.45 and a minimum compressive strength of 4,000 psi (28 MPa). A baseline starting point may include 600 lb/yd^3 [356 kg/m^3] cement, a 0.40 maximum water:cementitious materials ratio, and a MasterGlenium series high-range water-reducing admixture for producing a workable, low permeability concrete mixture. In addition, the use of silica fume, metakaolin or other supplementary cementitious materials (SCMs) can be used to further lower concrete permeability.

Step 3: Admixtures

MasterLife 300 Series, crystalline-based, permeability-reducing admixtures are a key component for producing durable, watertight concrete. MasterLife 300 Series admixtures are uniquely formulated to react in concrete, in the presence of moisture, to form additional hydration products and insoluble crystalline products that fill fine pores and seal hairline cracks in concrete.

Cracking is an enemy of concrete allowing water penetration and leakage. A major cause of concrete cracking is drying shrinkage. The use of a shrinkage-reducing or crack-reducing admixture such as MasterLife® SRA 035 or MasterLife CRA 007 is recommended to reduce drying shrinkage cracking potential. These admixtures can be used singularly or in combination with high-performance synthetic fibers such as MasterFiber® series of fibers to minimize/eliminate cracking, keep cracks tight if they do occur, and reduce the number of joints in a structure.

Steel-reinforcement in concrete can corrode if exposed to moisture, oxygen, and chlorides. Corrosion products expand causing concrete cracking and conditions for potential water leakage. In steel reinforced structures, the use of MasterLife CI 30, or MasterLife CI 222 corrosion-inhibiting admixtures, added during the batching process, are recommended to minimize corrosion cracking potential.

Step 4: Consolidation

Proper consolidation of fresh concrete is an important step to minimize water migration. Poorly consolidated concrete can contain pockets, channels or honeycombing allowing water penetration into and through structures. Master Builders Solutions recommends following ACI 309R-05 Consolidation of Concrete guidelines. In addition, the use of self-consolidating concrete (SCC) is a proven, viable option for challenging placement conditions and highly reinforced structures/elements.

Step 5: Fresh Concrete And Curing

The use of an evaporation retarder such as MasterKure® ER 50 and/or MasterFiber microfibers should be used with concrete exposed to high evaporation conditions, to help prevent plastic shrinkage cracking. Master Builders Solutions recommends water/moisture curing, if practicable, or the use of a MasteKure series curing compound to allow concrete to achieve low permeability and its full waterproofing performance potential

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