

Internal Curing with ***HydroMax***<sup>®</sup>

# Technology at work for you

## INCREASED CEMENT HYDRATION THROUGH INTERNAL CURING

Concrete curing is affected by both temperature and water and it is essential to provide the conditions for its optimization. Traditional external curing has been effectively utilized for conventional concrete in order to defer the drying of concrete, which causes shrinkage and possibly cracking, and to promote the continued hydration of the cementitious binder. However, for certain concrete, external curing might not be enough.

Concrete curing technology has been challenged by the advent of modern concrete mixes. This includes high performance concrete (HPC), decorative concrete, and pervious concrete among others. Also, in order to improve durability, many concrete mixtures incorporate supplementary cementitious materials (SCM) and/or utilize a much lower w/cm ratio. Both low w/cm and SCM present new challenges to conventional curing. Low w/cm decreases cement particle spacing leading to increased autogenous shrinkage while SCM generally requires moist curing for longer periods to hydrate.

HydroMax<sup>®</sup> internal curing admixture provides an internal source of water necessary to replace that consumed by chemical shrinkage during hydration. As the cement hydrates, this water is drawn from the pores in the admixture's water reservoirs and absorbed into the pores of the cement paste. This process can assist traditional curing techniques and minimize the development of autogenous shrinkage, help in avoiding early-age cracking, and improve strength.



HydroMax<sup>®</sup> innovative technology assists in properly curing concrete to become an extremely durable and strong mix for many applications.

#### APPLICATIONS:

Bridges, Columns, Dams, Decks, Highway Pavements, Interior Floors, Medians, Parking Lots, Parking Structures, RCC, Roads, Sidewalks, Slabs, Streets, Tilt-up Walls.

**HydroMax<sup>®</sup> Internal Curing Admixture**  
**Patent Pending**

## INTERNAL CURING APPLICATIONS

### Bridges

Bridges that have been internally cured have had 45 years of exceptional service record and have a proven record of relatively few cracks.

### Decorative and Architectural Concrete

Internal curing with HydroMax® assists in developing required characteristics in decorative concrete while preventing cracks, maintaining color, and obtaining the clear, clean patterns and sharp angles desired.

### Concrete Masonry Units

Internally cured concrete masonry units can have sharper corners and edges with increased compressive strength.

### Concrete Pipe

Internally cured concrete pipe can benefit from increased compressive strength and lower permeability, improving the performance of in-place service.

### High Performance Concrete (HPC)

Autogenous shrinkage is reduced by internal curing with HydroMax®, enabling HPC to overcome the difficulties of lower w/cm ratios and high cement content.

### Mass Concrete

Because mass concrete cannot be adequately cured from the outside in most circumstances, internal curing with HydroMax® better hydrates the cementitious materials improving the properties of the concrete.

### Parking Structures

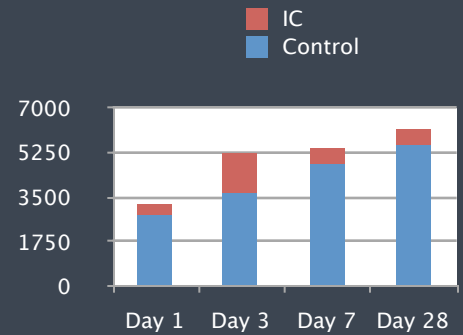
Parking Structures benefit from the reduced permeability internal curing offers and are less affected by deicing salts used on exposed parking surfaces and tracked in off the streets.

### Pervious Concrete

Internally curing pervious concrete with HydroMax® results in improved performance and durability while increasing ease of placement.

### Supplementary Cementing Materials (SCM)

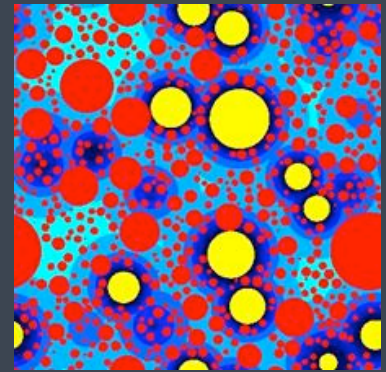
Internal curing maintains a higher internal humidity in concrete with SCM for a longer cure period that facilitates pozzolanic reaction and improves durability.



*Water-entrained cement-based materials I. Principles and theoretical background. (Jensen, Hansen)*

## IMPROVED STRENGTH

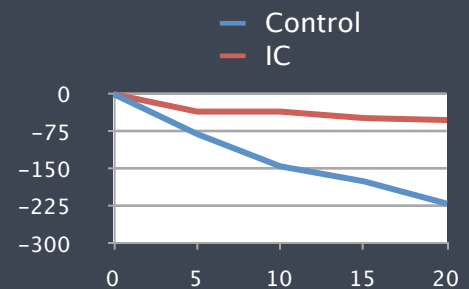
HPC's at 0.395 w/cm with 15% of Class F fly ash replacements for cement with internal curing. At ages from 1 d to 28 d, the mixture produced with internal curing exhibited strength gains over the control of as much as 44% at 3 days.



*Water Movement during Internal Curing: Direct Observation Using X-ray Microtomography (Bentz, Halleck, Grader, Roberts)*

## INCREASED HYDRATION

Two-dimensional slice from three-dimensional simulated water availability distribution for IC.



*Mitigating Autogenous Shrinkage by Internal Curing (Geiker, Bentz, Jensen)*

## REDUCED SHRINKAGE

Autogenous deformation of concrete mortars at 0.35 w/cm and 8% of silica fume with a curing temperature of 30 °C.

### Description

HydroMax® admixture is formulated to meet the requirements of ASTM C494 Type S, specific performance as an internal curing admixture used for making more durable and predictable high-performance concrete.

HydroMax® admixture increases the hydration of portland cement and other cementitious materials while facilitating placing and finishing operations. It can be used to capture and retain excess water in sensitive w/cm mixes like pervious concrete and to reduce the risk and expense of rejected loads.

### Applications

Recommended for:

- Supplementary cure for all concrete
- Increasing slump of concrete
- Increasing workability of HPC
- Increasing workability of low w/cm concrete
- Pumped concrete, shotcrete (wet mix) and conventionally-placed concrete
- Plain, reinforced, precast, prestressed, lightweight and normal weight concrete
- Pervious concrete

### Features

- Increased hydration of cement
- Improved mix optimization
- Improved workability
- Risk management

### Benefits

- Provides flexibility in placing and finishing operations
- Offsets the effects of slump loss
- Reduces waste associated with wet loads of concrete
- Increased strength – compressive and flexural
- Reduced early-age shrinkage
- Improved resistance to deicing chemicals
- Improved durability

### Performance Characteristics

**Rate of Hydration:** The temperature of a concrete mixture and the ambient temperature affect the hydration rate of hydraulic-cement. Concrete matures and develops hardened properties over time as a result of the continued hydration of the cement in the presence of sufficient water and heat. The function of HydroMax® is to maintain moisture conditions in a freshly placed cementitious mixture to allow hydraulic cement hydration and, if applicable, pozzolanic reactions to occur so that the potential properties of the mixture may develop. Within the normal dosage range, HydroMax® can generally extend the hydration time of concrete containing normal portland cement, fly ash, slag cement and silica fume approximately 3 to 7 days compared to a plain concrete mixture. Trial mixes should be made under approximate job conditions to determine the dosage required.

**Compressive Strength:** Concrete produced with HydroMax® admixture can develop higher ultimate strengths than plain concrete when used within the recommended dosage range and under normal, comparable curing conditions.

### Guidelines for Use

**Dosage:** HydroMax® admixture is recommended for use at a dosage of 1.5 oz/cwt of cementitious materials for most concrete mixtures using average concrete ingredients. Because of variations in job conditions and concrete materials, dosages other than the recommended amounts may be required. In such cases, contact your HydroMax® representative.

### Product Notes

**Corrosivity – Non-Chloride, Non-Corrosive:** HydroMax® admixture will neither initiate nor promote corrosion of reinforcing steel in concrete. This admixture does not contain intentionally-added calcium chloride or other chloride-based ingredients.

**Compatibility:** HydroMax® admixture may be used in combination with other non-chloride admixtures. When used in conjunction with another admixture, each admixture must be dispensed separately into the mix.

### Storage and Handling

**Storage:** HydroMax® admixture should be stored in an airtight container.

**Shelf Life:** HydroMax® admixture has a minimum shelf life of 12 months. Depending on storage conditions, the shelf life may be greater than stated. Please contact your HydroMax® representative regarding suitability for use and dosage recommendations if the shelf life of HydroMax® admixture has been exceeded.

### Packaging

HydroMax® admixture is supplied in specially designed pre-dosed canisters.

### Related Documents

Material Safety Data Sheets: HydroMax® internal curing admixture.

### Additional Information

For more information contact your HydroMax® representative.