

# DCI<sup>®</sup>S

Corrosion Inhibitor

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## Product Description

DCI<sup>®</sup>S corrosion inhibitor is a liquid admixture meeting the requirements of ASTM C1582, which is added to concrete during the batching process. It chemically inhibits the corrosive action of chlorides on reinforcing steel and prestressed strands in concrete. DCI<sup>®</sup>S has been formulated to provide set time characteristics similar to untreated concrete at 72°F (22°C). One gallon of DCI<sup>®</sup>S weighs approximately 10.7 lbs (one liter of DCI<sup>®</sup> weighs approximately 1.28 kg ± 0.01 kg). DCI<sup>®</sup>S contains a minimum of 30% calcium nitrite.

## Product Advantages

- Chemically inhibits the corrosive action of chlorides on reinforcing steel and prestressed strands in concrete
- Extends the service life of structures in a de-icing salt and marine environment
- Cost effective solution to the control of reinforcing steel chloride-induced corrosion
- Easy to use neutral set liquid admixture

## Facts about Steel Corrosion

Corrosion occurs in the presence of oxygen, moisture, and an electrolyte. As chlorides attack the reinforcing steel, the salt intensifies the electrolyte properties of concrete, thereby creating a corrosion cell. As the corrosion reaction occurs, rust is formed. It migrates away from the reinforcing bar, leaving more iron to be corroded. This process continues and two situations develop:

1. The reinforcing bars disintegrate, which reduces the flexural strength of the concrete structure; and,
2. Iron, as it oxidizes, expands to four times its original volume. This expansion results in physical disruption of the concrete. Typical results are cracks, stains, crazing, spalling and pot holes; all of which are safety hazards.

## Uses

DCI<sup>®</sup>S is recommended for all steel-reinforced, post tensioned and prestressed concrete that will come in contact with chlorides from de-icing salts or a marine environment. Examples are parking garage decks and support structures, bridge decks and prestressed members, and structures in marine environments. It may also be used in concrete where chlorides are added during manufacture.

## Preconstruction Trial Mix

It is strongly recommended that trial mixes be made several weeks before construction start up. This will allow the concrete producer an opportunity to determine the proper batching sequence and amounts of other admixtures needed in order to deliver the required concrete mix to the job site. Due to the cement response variation it is vital that set time and slump retention of the proposed mix be thoroughly tested and evaluated in the light of job requirements. GCP's broad experience with this product can help the concrete producer deliver satisfactory product regardless of the mixture proportions. Contact your GCP admixture representative for help with trial mixes.

## Performance

DCI®S corrosion inhibitor contains calcium nitrite which interacts with the embedded steel in concrete to prevent salt attack. By chemically reacting with the reinforcing steel, an improved oxide layer is formed, increasing the tolerance of the steel to chloride. Corrosion initiation is delayed and corrosion rates are kept under control. Once corrosion has been inhibited, physical disruption of the concrete due to rust formation will not occur.

When added to concrete in sufficient quantity as determined by the anticipated chloride ion content of the concrete over the design life of the structure, DCI®S maintains an active corrosion-controlling system within the concrete matrix

## Concrete Set Time

DCI®S is a neutral-set corrosion inhibitor formulated not to affect concrete setting times, which may also aggravate slump loss. In some cases, environmental conditions may require the addition of an accelerator or a retarder. In these cases, GCP's PolarSet®, a non-chloride accelerator, or a retarder such as DARATARD®17 may be added separately to the concrete mix.

## Air Entrainment

DCI®S corrosion inhibitor at the normal addition rates may moderately reduce the entrained air content. It may be necessary to increase the dosage of the air-entraining admixture to compensate. Project specifications for DCI®S generally will show requirements of  $6 \frac{1}{2} \pm 2 \frac{1}{2}\%$  air in the plastic or fresh concrete.

## Finishing and Curing

Concrete containing DCI®S Corrosion inhibitor finishes with standard tools and techniques. It is no different from any other air entrained, low water/cement ratio mix in terms of finishability. Curing procedures must follow ACI 302 and ACI 308.

## Addition Rates

Recommended addition rates range from 2.0 to 6.0 gal/yd<sup>3</sup> (10 to 30 L/m<sup>3</sup>). The level of corrosion protection increases in proportion to the dosage. The project specification will indicate the addition rate. In the absence of a specified dosage, or where needed to offset premixed chlorides, call your GCP admixture technical representative.

## Mix Water Reduction

Mix water adjustment is essential to account for the water in DCI®S and thus maintain the desired water/cement ratio. The mix water added at the batch plant must therefore be reduced to compensate for the addition of the corrosion inhibitor. The adjustment factor is 7.0 lbs per gallon of water (.84 kg/L) of DCI®S. A high-range water reducer such as ADVA®, DARACEM®100 or DARACEM®19 may be used to maintain workability in low water/ cement ratio concrete.

## Compatibility with Other Admixtures and Batch Sequencing

DCI®S is compatible with most GCP admixtures as long as they are added separately to the concrete mix, usually through the water holding tank discharge line. In general, it is recommended that DCI®S be added to the concrete mix near the end of the batch sequence for optimum performance. Different sequencing may be used if local testing shows better performance. Please see GCP Technical Bulletin TB-0110, *Admixture Dispenser Discharge Line Location and Sequencing for Concrete Batching Operations* for further recommendations. DCI®S should not come in contact with any other admixture before or during the batching process, even if diluted in mix water.

Pretesting of the concrete mix should be performed before use, and as conditions and materials change in order to assure compatibility, and to optimize dosage rates, addition times in the batch sequencing and concrete performance. For concrete that requires air entrainment, the use of an ASTM C260 air-entraining agent (such as DARAVAIR® or DAREX® product lines) is recommended to provide suitable air void parameters for freeze-thaw resistance. Please consult your GCP representative for guidance.

## Cement Compatibility

DCI®S Corrosion inhibitor is compatible with all types of Portland cements, and concretes containing pozzolans. However, due to the significant variations between cements, even the same type, differences in cement response to DCI®S may result. This is especially true with respect to the effect on setting time, which also influences slump retention.

## Packaging

DCI®S Corrosion inhibitor is available in bulk quantities from GCP Applied Technologies metered systems or in 55 gallon (208 L) drums.

## Dispensing Equipment

A complete line of accurate dispensers is available. DCI®S may be introduced on the sand, in the water, at the beginning or the end of the batch cycle. Similar to all concrete admixtures, DCI®S should not come into contact with other admixtures prior to entering the concrete.

## Freezing Point

DCI®S freezes at approximately 5 °F (-15 °C), but its corrosion inhibition properties are completely restored by thawing and thorough agitation.

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