

Protectosil® CIT

CORROSION INHIBITOR TREATMENT Product Data and Test Information



PRODUCT NAME

Protectosil® CIT

Advanced organofunctional corrosion inhibitor treatment for steel-reinforced concrete.

MANUFACTURER

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PROTECTOSIL PRODUCTS ARE MANUFACTURED AT THE EVONIK DEGUSSA CORPORATION THEODORE, ALABAMA, PLANT AND THE EVONIK INDUSTRIES GMBH PLANT IN RHEINFELDEN, GERMANY, UNDER A QUALITY SYSTEM CERTIFIED TO ISO-9001 AND ISO-14001 REQUIREMENTS.

PRODUCT DESCRIPTION

A surface-applied clear liquid that penetrates concrete and provides an organofunctional molecule to inhibit the electrochemical corrosion process between the rebar and the chloride ions, and oxygen and moisture within the concrete.

Protectosil CIT:

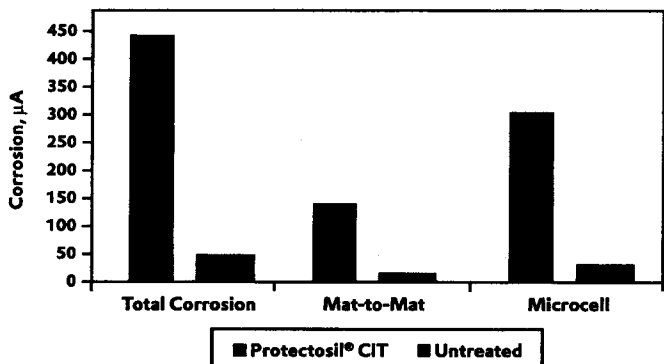
- Dramatically reduces the chloride-ion-induced corrosion rate of concrete steel reinforcement
- Reduces corrosion in carbonated concrete steel-reinforced structures
- Is an easy-to-use treatment that penetrates the concrete and chemically bonds with steel, cement paste and other siliceous material
- Will not discolor or change the substrate's surface appearance or surface friction
- Effectively inhibits macrocell (mat-to-mat) and microcell (along rebar) corrosion of steel-reinforced concrete
- Mitigates corrosion of rebar even in structures subjected to an environment with high relative humidity
- Repels additional water and chloride ions

APPROPRIATE APPLICATIONS

- Steel-reinforced cast-in-place, precast, post tension, GFRc, prestressed or other steel-reinforced concrete
- Parking decks, facades, balconies, walkways, piers, bridge decks, beams, columns and other steel-reinforced concrete structures
- Marine environments with high relative humidity and areas where deicer salts are used

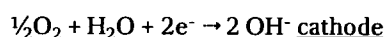
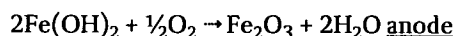
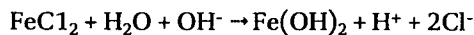
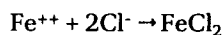
ADVANTAGES

Protectosil CIT dramatically decreases both mat-to-mat (>90%) and microcell (>87%) corrosion currents.



As the chart above shows, the proprietary organofunctional chemistry of **Protectosil CIT** can greatly reduce corrosion currents. This is done chemically by interrupting the electrolytic current and causing a slowdown of the corrosion process.

The corrosion process in steel-reinforced concrete is spontaneous and similar to the process in a galvanic cell or battery. The electrochemical reactions can be described as follows:



(Continued)

In the corrosion process, ferrous oxide (rust) takes up more volume than the original steel and causes stress on the concrete. This stress manifests itself as cracks, spalls and delaminations in the concrete structure. But the main consequence of concrete corrosion is the loss of steel cross section and the resulting loss of structural capacity. The three main factors affecting the corrosion rate are the concentrations of chloride ions, moisture and oxygen. Other factors, such as temperature, also contribute to the speed of the corrosion process. Warm, humid environments, such as coastal areas, accelerate the corrosion process and cause very rapid deterioration.

Protectosil CIT works on the molecular level to effectively inhibit the electrochemical interaction of the corrosion process. This advanced inhibiting action makes **Protectosil CIT** the best choice for difficult applications.

Applied to concrete structures repaired with polymer concrete, **Protectosil CIT** can equalize the differences in electrochemical potential between the polymer concrete and the existing concrete.

The product:

- Inhibits corrosion of carbon and galvanized steel rebar
- Is effective in both marine and high-humidity environments
- Is easy to apply
- Is effective in heavily chloride-contaminated concrete
- Is effective in carbonated concrete
- Complies with VOC regulations
- Is vapor permeable
- Dries quickly
- Prevents ingress of additional chlorides

TECHNICAL DATA

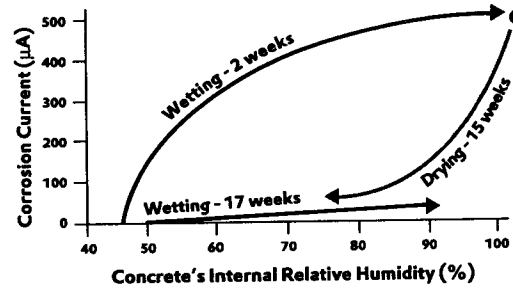
Protectosil CIT is a proprietary liquid organofunctional material.

Color	clear to slightly amber
Density	0.88 g/cm ³
pH	7 to 8
Flash Point	63°C (145°F)
Viscosity	0.95 mPa s
VOC	<400 g/l

PERFORMANCE DATA

Cracked Concrete Beam Test (adapted from ASTM G109): **Protectosil CIT** reduces the corrosion rate by 90% versus the control specimen after 1 year.

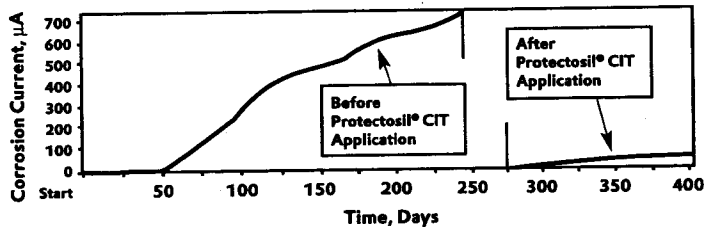
Effectiveness of Protectosil CIT at Various Levels of Internal Concrete Relative Humidity



- Untreated concrete - increase in corrosion during wetting cycle
- Untreated concrete - decrease in corrosion during drying cycle
- Protectosil® CIT during wetting cycle

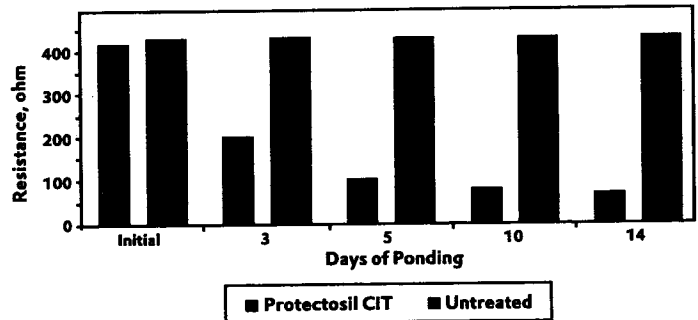
Effectiveness of Protectosil CIT on Heavily Corroding Reinforced Concrete

Corrosion Currents During Salt Water Exposure Cycle, Before and After Protectosil CIT Application



The testing shown above consisted of steel-reinforced concrete slabs exposed to weekly cyclic salt water exposure. Once the slabs reached a high level of corrosion, **Protectosil CIT** was applied. The **Protectosil CIT** treatment reduced the total corrosion current by more than 90%.

Effectiveness of Protectosil CIT on Concrete Resistivity



The higher the resistivity or electrical resistance of the concrete, the lower the corrosion current.

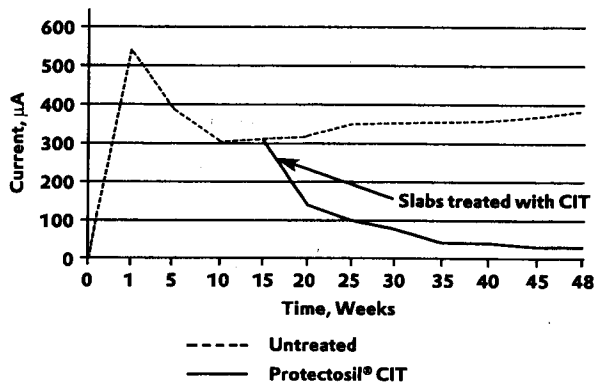
PROTECTOSIL CIT EFFECTIVENESS ON FHWA CRACKED BEAM CONCRETE

The Federal Highway Administration has developed testing protocol for evaluating inhibitors and coated rebar in aggressive corrosion environments. The testing is carried out under 48 weeks of cyclic salt water ponding (15% salt), high relative humidity (70% to 80%) and elevated temperatures (100°F). To make the test more realistic, the test specimens were cracked along the length of the reinforcement to simulate transverse bridge deck cracking. The results are illustrated in the chart below and summarized as follows:

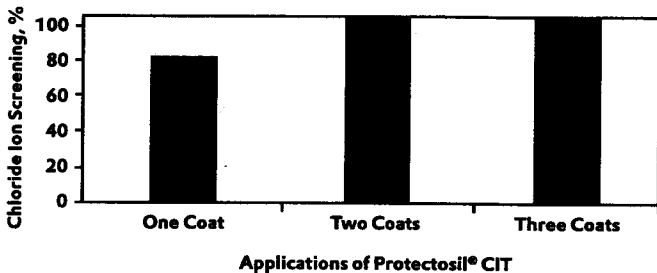
Cracked concrete, no preexisting corrosion: 99% reduction of corrosion compared to untreated specimens

Cracked concrete, existing corrosion: 92% reduction of corrosion compared to untreated specimen

Effectiveness of Protectosil® CIT on Active Corrosion



Effectiveness of Protectosil CIT on Chloride Ion Screening After Accelerated Weathering by ASTM G 85 and ASTM D4587



CONCRETE REPAIRS

All delaminated, loose or spalled concrete must be removed and repaired. Shrinkage cracks that are dormant, shallow in depth and lacking structural significance can be treated with a multiple-coat application of **Protectosil CIT**. Other cracks

should be routed, treated with **Protectosil CIT** and then sealed with a suitable sealant. **Protectosil CIT** does not affect the adhesion of most sealants to concrete or that of concrete to rebar. **Protectosil CIT** may be applied directly to the cleaned rebar prior to placing repair material.

SURFACE PREPARATION

Concrete surface must be cleaned to remove all traces of dirt, dust, efflorescence, mold, grease, oil, asphalt, laitance, paint, coatings, curing compounds and other foreign materials that would inhibit penetration. Acceptable cleaning methods include shotblasting, sandblasting, waterblasting, grinding and chemical cleaning. Check with your **Protectosil** representative to verify that surface preparation is adequate.

INSTALLATION

Apply multiple coats of **Protectosil CIT** to entire concrete surface, including repaired areas. Allow a minimum of 15 minutes between coats (or until visibly dry). Most applications require two or three coats at 175 to 225 ft²/gal (230 to 180 ml/m²) for each coat. The exact amount of **Protectosil CIT** will depend on the present corrosion rate, the chloride ion level and the service environment of the structure. Check with your **Protectosil** representative to confirm exact number of coats and coverage rate for your particular project.

Protectosil CIT should be applied to concrete using low-pressure pumping equipment with a wet fan type spray nozzle. Alternate methods include roller, brush or pouring (in crack for example). Do not alter or dilute the material. Do not apply to a wet or damp substrate.

APPLICATION CONDITIONS

The proper application conditions are between 40°F and 100°F (5°C to 38°C). Lower or higher application temperatures require prior written approval from our technical service department. Do not apply if rain is expected within 4 hours following application, or if high winds or other conditions prevent proper application. The substrate should be as dry as possible prior to application. Depending on weather conditions, allow between 24 and 72 hours for the substrate to dry after rain or cleaning with water.

Precautions: Please read the **Protectosil CIT** material safety data sheet for detailed information. Keep containers away from heat, sparks, open flame and other sources of ignition. **Protectosil CIT** containers should be kept closed when not in use and should be stored at temperatures between 0°F and 120°F (-18°C and 50°C), away from rain and standing water.

WARRANTY

Evonik Degussa Corporation offers a corrosion control warranty for the proper application of **Protectosil CIT**. The warranty is based on maintaining the steel corrosion current in a low-corrosion or passive state. Corrosion rates are determined by linear polarization devices verified as accurate by independent researchers. The time period covered by the warranty depends on the present corrosion rate, the service environment and the steel reinforcement orientation. Contact your Protectosil representative for a complete evaluation of your structure.

AVAILABILITY

Protectosil CIT is available in 5- and 55-gallon drums (20 and 210 liters) to approved applicators, F.O.B. to various warehouses throughout the United States, Canada and Mexico. Contact us at 1 (800) 828-0919 for the sales representative in your area.

For more information, MSDS and the most updated product information, and to find your local representative, go to www.protectosil.com.

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