Sika® FerroGard®-670

PRODUCT DESCRIPTION

Sika® FerroGard®-670 is a zinc based discrete sacrificial anode placed inside a concrete repair area in reinforced concrete structures which are corroding as a result of chloride induced corrosion. Sika® FerroGard®-670 anodes are placed along the perimeter of the repair area and fixed to the reinforcement prior to the application of a concrete repair system. The reinforcement outside the repaired area is at greatest corrosion risk owing to the passive condition of the reinforcement within the repaired area. Sika® FerroGard®-670 anodes corrode preferentially to the surrounding reinforcement offering protection against incipient corrosion damage.

USES

Sika® FerroGard®-670 may only be used by experienced professionals. Patch repairs within concrete or along joints between new and existing concrete. Effective in chloride contaminated and carbonated concrete. Used to prevent the “Halo” or “Ring” anode Corrosion effect.

CHARACTERISTICS / ADVANTAGES

- Anode Mortar Shell - uses proprietary technology that provides excellent transport of reactants to the surface of the zinc anode and corrosion products away from the surface of the zinc, using a chelation process. The encasing mortar will not cause corrosion of reinforcing steel.
- Proven technology – supported by 10+ years of development and testing.
- Auto-Corrosion – encasing mortar maintains performance but does not auto- or self-corrode the zinc anode.
- Ease of Installation – uses standard attachment methods known to industry.
- Self-Powered / Self Regulating – creates own protective current that adjusts to demand.
- Maintenance Free – requires no monitoring or maintenance.
- Safe to Use – protects conventional and pre-stressed / post-tension reinforcing steel; moderate pH safe to handle without PPE.
- Tie Wires – galvanized steel tie wires (annealed) are pre-twisted to form a cradle that accepts reinforcing steel, enables a better electrical contact and extends “throwing power”.
- Service Life – capable of 10+ years of protection depending on design and conditions.
PRODUCT INFORMATION

Packaging
24 anodes per box

Appearance / Color
Zinc anode core surrounded by a cementitious mortar casing with two integral conducting galvanised tie wires

Shelf Life
Nominal shelf life of 5 years.

Storage Conditions
Avoid temperatures >100°F

Zinc Weight
105 g (Anode surface area: 26 450 mm²)

TECHNICAL INFORMATION

Charge Capacity
738 A-hr/kg

Design Considerations
Electro-Potential
-850 to -1150 mV, CSE (water saturated)

Auto-corrosion
<0.1 mm / year

SYSTEM INFORMATION

System Structure
• Sika® FerroGard®-670
• Bridging Mortar
• PH: ~11.5

Other anode sizes are available with different zinc content:

<table>
<thead>
<tr>
<th>Name</th>
<th>Zinc content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sika® FerroGard®-650</td>
<td>65 g</td>
</tr>
<tr>
<td>Sika® FerroGard®-675</td>
<td>160 g</td>
</tr>
</tbody>
</table>

Zinc Anode: Conforms to ASTM B418 Type II, Standard Specification for Cast and Wrought Galvanic Zinc Anodes.
High Surface Area for optimum performance: 40 in²

APPLICATION INSTRUCTIONS

NOTES ON INSTALLATION

Spacing: Multiple factors must be considered to determine the spacing of the FerroGard® anode, including the structure’s temperature, moisture content, chloride content, the steel surface area and placement. In most applications, the spacing should not exceed 30 inches. A design engineer should always be consulted to confirm final requirements. Consult FerroGard® Anode Calculation sheet for engineered designs or refer to the Maximum Anode Spacing Chart below.

APPLICATION

Surface Preparation
All loose and spalled concrete should be removed in accordance with ICRI Guideline No. 310.1R-2008 Guideline for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion. The Sika FerroGard® anode positioning should be considered when removing the existing concrete.

Preparation

For correct electrical connection and anode function, the surface of the reinforcing steel should be untreated and cleaned to a near white surface condition in areas designated for the connection of the FerroGard® anode. Refer to SSPC SP-10. Note, pre-soaking the Sika FerroGard® anodes in clean water for several minutes prior to installation is recommended to minimize dehydration of the repair mortar.

Continuity
The reinforcing steel within the patch area should be tested for continuity: DC resistance between bars should be ≤ 1 Ω. Make continuity corrections, if needed, by welding steel bonding wire between bars to achieve a DC resistance ≤ 1 Ω.

Positioning
In most applications, the FerroGard® anode should be positioned at the perimeter of the repair and on plane with the reinforcing steel to provide a proper level of cover. Anodes must be positioned so that the entire anode and the wire connections to the reinforcing steel are totally covered by the repair material once the repair is complete. Note: Do not modify the shape of the anode to fit a hole.

Attaching
Tighten the two pairs of pre-twisted wires around the reinforcing steel in a double wrap pattern to achieve a sound electrical bond. The pre-twisted wire connectors provide a sound base, good electrical contact and proper spacing from the reinforcing steel to which the anode is attached. No additional form of attachment or electrical connection is necessary. Note: Use only the connector wires attached to the anode; do not use supplementary connection methods between the connector loops and the rebar nor use a twisting tool to tighten the wires.

**Verification**
Verify sound electrical connection of the FerroGard® system to the reinforcing steel by checking for a DC resistance ≤ 1 Ω.

**Note:** Conventional, commercially available repair mortars should be used to repair the concrete and encase the FerroGard® anodes. The mix should have a resistivity of ≤20,000 Ω-cm. High polymer content and silica fume should not be used in the mix. If the repair design requires a mix with resistivity >20,000 Ω-cm, then use an encasement mortar to encase the anode and bridge the area between the anode and the existing concrete. SikaRepair® 222 (with water) or SikaRepair® 223 (with water) are acceptable encasement mortars. Place encasement materials in accordance with conventional techniques to assure good consolidation. Rebar coatings such as Sika Armatec 110 EpoCem and Sikadur 32 can and should be used along with Sika FerroGard anodes as full system repair approach. The sketches below depict the proper way to install the rebar coating (and bonding agent). All the usual preparation techniques are employed (geometry of the repair area, cleaning the steel, surface preparation). The anodes are tied to the steel, continuity is verified and the rebar coating is applied as per the PDS. Please note, avoid coating the anode itself. The tie wires may be coated too as long as continuity to the steel is ensured.

Do not use any form of battery or impressed current in association with the FerroGard® anode or apply an electrical current to the reinforcing steel prior to or after the repair. Do not install a preformed high resistivity or non-conductive barrier between the FerroGard® anode and the reinforcing steel. Do not apply corrosion inhibitors directly on the FerroGard® anode body or connecting wires, especially on or near the wire connection point with the reinforcing steel.

### Maximum Anode Spacing for Moderate-Low Corrosion Risk Environment

<table>
<thead>
<tr>
<th>Steel Density Ratio</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.2</td>
<td>30</td>
</tr>
<tr>
<td>0.21-0.46</td>
<td>27</td>
</tr>
<tr>
<td>0.47-0.70</td>
<td>25</td>
</tr>
<tr>
<td>0.71-0.93</td>
<td>23</td>
</tr>
<tr>
<td>0.94-1.15</td>
<td>22</td>
</tr>
<tr>
<td>1.16-1.36</td>
<td>20</td>
</tr>
<tr>
<td>1.37-1.56</td>
<td>19</td>
</tr>
<tr>
<td>1.57-1.75</td>
<td>19</td>
</tr>
<tr>
<td>1.75-1.93</td>
<td>18</td>
</tr>
<tr>
<td>1.94-2.1</td>
<td>17</td>
</tr>
</tbody>
</table>

### Maximum Anode Spacing for High Corrosion Risk Environment

<table>
<thead>
<tr>
<th>Steel Density Ratio</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.2</td>
<td>27</td>
</tr>
<tr>
<td>0.21-0.46</td>
<td>24</td>
</tr>
<tr>
<td>0.47-0.70</td>
<td>22</td>
</tr>
<tr>
<td>0.71-0.93</td>
<td>20</td>
</tr>
<tr>
<td>0.94-1.15</td>
<td>19</td>
</tr>
<tr>
<td>1.16-1.36</td>
<td>17</td>
</tr>
<tr>
<td>1.37-1.56</td>
<td>16</td>
</tr>
<tr>
<td>1.57-1.75</td>
<td>16</td>
</tr>
<tr>
<td>1.75-1.93</td>
<td>15</td>
</tr>
<tr>
<td>1.94-2.1</td>
<td>14</td>
</tr>
</tbody>
</table>
Common Steel Density Ratio Examples

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>One Mat/One Way</th>
<th>Two Mat/Two Way</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4</td>
<td>0.13</td>
<td>0.52</td>
</tr>
<tr>
<td>#5</td>
<td>0.16</td>
<td>0.65</td>
</tr>
<tr>
<td>#6</td>
<td>0.20</td>
<td>0.79</td>
</tr>
<tr>
<td>#7</td>
<td>0.23</td>
<td>0.92</td>
</tr>
<tr>
<td>#8</td>
<td>0.26</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Assumption: Bars are 12” On Center

Calculating Steel Density Ratio (Surface Area of Steel + Surface Area of Concrete):

Surface Area of Steel ÷ Surface Area of Concrete

Surface area of steel = \(\pi \times D \times L \times n\)

Surface area of concrete = 12” x 12” = 144 in²

\(\pi = 3.14\)

\(D = \) bar diameter

\(L = \) length of bars in calculated area (always 12” in this calculation)

\(n = \) number of bars in calculated area (12”÷ spacing)

Sample Calculation #1

Heavily Reinforced: #8 bars, 2 mats, 2 ways, 8” oc

Top mat, transverse: \(3.14 \times \frac{8}{8”} \times 12” \times 12”/8” \text{ oc} ÷ 144\) in² = 0.39

Top mat, longitudinal = 0.39
Bottom mat, transverse = 0.39
Bottom mat, longitudinal = 0.39
Total = 1.57

Sample Calculation #2

Moderately Reinforced #5 bars, 2 mats, 2 ways, 12” oc

Top mat, transverse: \(3.14 \times \frac{5}{8”} \times 12” \times 12”/12” \text{ oc} ÷ 144\) in² = 0.16

Top mat, longitudinal = 0.16
Bottom mat, transverse = 0.16
Bottom mat, longitudinal = 0.16
Total = 0.65

Sample Calculation #3

Lightly Reinforced: #4 Bars, 1 mat, 2 ways, 16” oc

Transverse = \(3.14 \times \frac{4}{8”} \times 12” \times 12”/16” \text{ oc} ÷ 144\) in² = 0.1

Longitudinal: 0.1
Total: 0.2

LIMITATIONS

- Only repair mortar with a resistivity lower than 20 000 \(\Omega\cdot\text{cm}\) must be used to repair the concrete and encase the anodes.
- Mortar containing high polymer content and/or high silica fumes content must not be used as their resistivity will generally be too high. Use bridging mortar as required.
- Do not use any form of battery or impressed current in association with the Sika® FerroGard®-670 anode.
- Do not install a preformed high resistivity or non-conductive barrier between Sika® FerroGard®-670 anodes and the steel reinforcement.
- Do not apply corrosion inhibitors directly on the Sika® FerroGard®-670 anode unit or connecting wires, especially on or near the steel reinforcement and wire connection point.
- Concrete repairs must be undertaken in accordance to an acknowledged national standard such as EN 1504.
- Any discontinuous reinforcement must be either electrically bonded to or electrically isolated from the system negative.
- Design of the galvanic protection system must be undertaken by an experienced qualified corrosion design engineer.
- Installation must be carried out in accordance with engineers design and specification.

BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

OTHER RESTRICTIONS

See Legal Disclaimer.

ENVIRONMENTAL, HEALTH AND SAFETY

For further information and advice regarding transportation, handling, storage and disposal of chemical products, user should refer to the actual Safety Data Sheets containing physical, environmental, toxicological and other safety related data. User must read the current actual Safety Data Sheets before using any products. In case of an emergency, call CHEMTREC at 1-800-424-9300, International 703-527-3887.
LEGAL DISCLAIMER

• KEEP CONTAINER TIGHTLY CLOSED
• KEEP OUT OF REACH OF CHILDREN
• NOT FOR INTERNAL CONSUMPTION
• FOR INDUSTRIAL USE ONLY
• FOR PROFESSIONAL USE ONLY

Prior to each use of any product of Sika Corporation, its subsidiaries or affiliates (“SIKA”), the user must always read and follow the warnings and instructions on the product’s most current product label, Product Data Sheet and Safety Data Sheet which are available at usa.sika.com or by calling SIKA’s Technical Service Department at 800-933-7452. Nothing contained in any SIKA literature or materials relieves the user of the obligation to read and follow the warnings and instructions for each SIKA product as set forth in the current product label, Product Data Sheet and Safety Data Sheet prior to use of the SIKA product.

SIKA warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current Product Data Sheet if used as directed within the product’s shelf life. User determines suitability of product for intended use and assumes all risks. User’s and/or buyer’s sole remedy shall be limited to the purchase price or replacement of this product exclusive of any labor costs. NO OTHER WARRANTIES EXPRESS OR IMPLIED SHALL APPLY INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SIKA SHALL NOT BE LIABLE UNDER ANY LEGAL THEORY FOR SPECIAL OR CONSEQUENTIAL DAMAGES. SIKA SHALL NOT BE RESPONSIBLE FOR THE USE OF THIS PRODUCT IN A MANNER TO INFRINGE ON ANY PATENT OR ANY OTHER INTELLECTUAL PROPERTY RIGHTS HELD BY OTHERS.

Sale of SIKA products are subject to the Terms and Conditions of Sale which are available at https://usa.sika.com/en/group/SikaCorp/termsandconditions.html or by calling 201-933-8300.