SIKA SPECIFICATION NOTE: This guide specification is provided in CSI Format for use by design professionals for individual construction projects. Modify the text based on your project requirements, and delete products not required. Coordinate designations of corrosion inhibitor types in this specification with corrosion inhibitor types indicated on the Drawings. Questions? Call 800-933-SIKA.

SIKA SPECIFICATION NOTE: This guide specification includes test methods, materials and installation procedures for Sika FerroGard 650, 670 and 675 embedded galvanic anodes for reinforced concrete by Sika Corporation. Sika FerroGard 650, 670 and 675 may be used in the repairs of concrete and in new concrete.

SECTION 03 93 10

Embedded Galvanic Anodes

1. GENERAL
   * + 1. RELATED DOCUMENTS
          1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
       2. SUMMARY
          1. Provide an embedded galvanic anode in repairs of concrete or in new concrete in order to reduce the effects of corrosion and provide protection from incipient anode formation.

Work includes substrate preparation including crack and joint treatment.

* + - * 1. Related Work: The following items are not included in this Section and are specified under the designated Sections:

Section 03 30 00 – CAST-IN-PLACE CONCRETE.

Section 07 18 13 – PEDESTRIAN TRAFFIC COATINGS.

Section 07 18 16 – VEHICULAR TRAFFIC COATINGS.

Section 07 92 13 – ELASTOMERIC JOINT SEALANTS

Section 09 96 53 – ELASTOMERIC COATINGS.

* + - 1. PERFORMANCE REQUIREMENTS
         1. The embedded galvanic anodes are intended to mitigate active corrosion, and/or delay the onset of corrosion.

System shall perform as a sacrificial zinc anode.

Manufacturer shall provide all embedded galvanic anode materials that are physically and chemically compatible when installed in accordance with manufacturer’s current application requirements.

* + - 1. references
         1. ACI/ICRI 2008 Concrete Repair Manual
         2. ACI Guideline No. 222 – Corrosion of Metals in Concrete
         3. ICRI Guideline 310.1R-2008 Guide for Surface Preparation for the Repair of Deteriorated Concrete resulting from Reinforcing Steel Corrosion.
         4. ASTM A615/A615M-09 Standard Specification for Deformed and Plain Billet-Steel Bar for Concrete Reinforcement.
         5. ASTM B418-12, Type II Standard Specification for Cast and Wrought Galvanic Zinc Anodes.
         6. ASTM B6-09 Standard Specification for Zinc.
         7. ASTM A82-07 Specification for Plain Steel Wire for Concrete Reinforcement.
      2. SUBMITTALS
         1. Submittals: Comply with project requirements for submittals as specified in Division 01.
         2. Product Data:

Materials list of items proposed to be provided under this Section.

Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

* + - * 1. Site mockup: For confirmation of performance, construction sequencing and standard of acceptance. Complete prior to commencing with the project.
        2. Pre-Construction Field Adhesion Testing: Written results of field tests, including summary of joint preparation, surface preparation, products used and installation techniques.
        3. Sustainable Design Submittals: For projects seeking USGBC LEED certification, submit manufacturer’s printed statement of VOC content and manufacturing location relative to project site for product used.
      1. QUALITY ASSURANCE
         1. Installer Qualifications:

Installer shall have at least three years’ experience in installing materials of types specified and shall have successfully completed at least three projects of similar scope and complexity.

Installer shall designate a single individual as project foreman who shall be on site at all times during installation.

* + - * 1. Applicable Regulations: Comply with local code and requirements of authorities having jurisdiction. Do not exceed VOC regulations as established by the State in which they are being installed; including total VOC content, in grams per liter, for all system components (i.e. primers, adhesives, coatings, and similar items.)
      1. PRE-INSTALLATION CONFERENCE
         1. Prior to scheduled commencement of the embedded galvanic anode installation and associated work, conduct a meeting at the project site with the installer, architect/consultant, owner, manufacturer’s representative and any other persons directly involved with the performance of the Work. The Installer shall record conference discussions and include decisions and agreements reached (or disagreements), and furnish copies of recorded discussions to each attending party. The main purpose of this meeting is to review foreseeable methods and procedures related to the Work.
      2. DELIVERY, STORAGE AND HANDLING
         1. Embedded galvanic anode materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.
         2. Store embedded galvanic anode materials off the ground and protect from rain or excessive heat until ready for use.
         3. Condition the specified product as recommended by the manufacturer.
      3. PROJECT CONDITIONS
         1. Protection: Precautions should be taken to avoid damage to any surfaces near the work zone.
      4. WARRANTY
         1. Warranty: Provide manufacturer’s standard warranty for each type of product. Warranty shall include manufacturer’s statement that materials in contact with another have been tested and verified to be compatible. Include written testing documentation and test reports if requested by Architect.

1. PRODUCTS
   * + 1. MANUFACTURER
          1. Basis-of-Design Manufacturer: Sika Corporation, 201 Polito Avenue, Lyndhurst NJ 07071. Toll Free 800-933-SIKA (7452), www.sikausa.com. No substitutions without prior written approval by the Architect.
          2. Embedded galvanic anode: Sika FerroGard 650, 670 and 675 shall have the following properties:
2. In compliance with ASTM B6, with a pair of integrated annealed and galvanized steel tie wires.
3. The steel wire ties for connection to the reinforcing steel shall be unspliced.
4. Encasement shall be a highly conductive mortar. The encasement mortar, when used in conjunction with the embedded galvanic anode, shall not cause corrosion of the reinforcing steel.
5. Deliver, store, and handle all materials in accordance with manufacturer’s instructions.
6. The anodes shall be supplied with solid zinc manufactured in accordance to ASTM B418 – Type II Anode Grade Zinc core with a capacity of 738 A-hr/kg.
7. The anodes shall be encased in a highly conductive mortar with a resistivity of <500 ohm-cm.
8. The anodes shall be encased in a highly conductive mortar that causes nil auto-corrosion or self-corrosion of the zinc anode while in storage or in service at rate of <0.1 mm/year.
9. The anodes shall be encased in a highly conductive mortar that produces a dry saturated condition electro-potential of -850 to -1100 mV, CSE.
10. The encasing mortar, when used in conjunction with the embedded galvanic anode, shall not cause corrosion or be detrimental to the reinforcing steel or surrounding concrete.
11. The anode shall be supplied with integral and unspliced, annealed and galvanized tie wires manufactured in accordance to ASTM A82 and ASTM 633. The wires shall be pre-twisted to form a cradle to accept the reinforcing steel.
12. Third party product evaluation testing required to support adherence to these requirements.
    * + - 1. Embedded galvanic anode: Sika FerroGard 650 with the following additional properties:

1. Same as section 2.1 B and

2. Nominal dimensions shall fall within the following parameters: 4.5” by 2.75” by 0.75” (114 mm x 69 mm x 19 mm)

3. Manufactured with 65g of zinc.

4. The zinc anode surface area shall be min of 21 in².

* + - * 1. Embedded galvanic anode: Sika FerroGard 670 with the following additional properties:

1. Same as section 2.1 B and
2. Nominal dimensions shall fall within the following parameters: 4.5” by 2.75” by 1.0” (114 mm x 69 mm x 25 mm)
3. Manufactured with 105g of zinc.
4. The zinc anode surface area shall be min of 41 in².
   * + - 1. Embedded galvanic anode: Sika FerroGard 675 with the following additional properties:

1. Same as section 2.1 B and

2. Nominal dimensions shall fall within the following parameters: 4.5” by 2.75” by 1.10” (114 mm x 69 mm x 28 mm)

3. Manufactured with 160g of zinc.

4. The zinc anode surface area shall be min of 42 in².

* + - * 1. Testing: Unless indicated otherwise, performance testing in this Section was performed at ambient temperature, with curing conditions of 73 degrees F and 50 percent relative humidity.
        2. Concrete Repair and Patching Materials: As recommended by manufacturer of embedded galvanic anodes.
        3. Elastomeric Sealants: As recommended by manufacturer of embedded galvanic anodes. For exterior joints in vertical surfaces such as, but not limited to control and/or expansion joints in cast-in-place concrete or unit masonry, joints between architectural pre-cast concrete units, joints between dissimilar materials or perimeter joints at frames of doors, windows, storefronts, louvers and similar openings apply a low-modulus, single-component or multi-component non-sag sealant in compliance with ASTM C920, Type S or M, Grade NS, Class 25, Class 35, Class +50/-50, Class +100/-50. Acceptable products:

Sikaflex 1a, a premium-grade, high-performance, moisture-cured, 1-component, polyurethane-based, non-sag elastomeric sealant.

Sikaflex 2c, a 2-component, premium-grade, polyurethane-based chemical cure, elastomeric sealant.

Sikaflex 15 lm a low-modulus, high-performance, 1-component, polyurethane-based, non-sag elastomeric sealant.

1. EXECUTION
   * + 1. EXAMINATION
          1. Verify that surfaces and conditions are ready to accept the Work of this section. Verify surfaces are clean, dry, sound and free of voids, deformations, protrusions and contaminants that may inhibit application or performance of the elastomeric coatings Notify Architect in writing of any discrepancies. Commencement of the Work in an area shall mean Installer’s acceptance of the substrate.
       2. PREPARATION
          1. Verify that the surfaces are clean and open texture.
          2. Reinforcing steel must be clean and prepared in accordance with ICRI Guideline No. 310.1R-2008 Guideline for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.
       3. APPLICATION OF CONCRETE REPAIR AND PATCHING MATERIALS
          1. Fill all visible hairline cracks and surface defects with appropriate Sika repair mortar, leveling mortar or surface filler prior to applying coating primer. Bugholes or irregularities of substrate shall be leveled with specified leveling mortar or surface fillers as appropriate.
       4. CRACK TREATMENT FOR CONCRETE
          1. For non-structural cracks greater than 12 mils rout and seal the crack to a 1/4 inch by 1/4 inch profile and properly seal with a flexible, specified elastomeric joint sealant.
          2. For structural static cracks, inject with a suitable epoxy.
       5. APPLICATION OF THE EMBEDDED GALVANIC ANODE
          1. The embedded galvanic anode is delivered ready to be used.

B. 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.

C. Positioning: In most applications, the Sika 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.

*Specifer 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.*

*Specifier Note: Do not modify the shape of the anode to fit a hole.*

D. Continuity: The reinforcing steel within the repair 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.

E. 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.

*Specifier 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.*

Spacing for embedded galvanic anodes, in typical applications is not to exceed 30 in. (762 mm). See the Sika FerroGard® data sheet for more detailed anode spacing guidelines. Desired service life and environmental conditions should be considered when calculating anode spacing.

F. Verification: Verify sound electrical connection of the Sika FerroGard® embedded anode to the reinforcing steel by checking for a DC resistance ≤ 1 Ω.

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, encase the anode and bridge the area between the anode and the existing concrete with SikaRepair 222 (with water) or SikaRepair 223 (with water). Place encasement materials in accordance with conventional techniques to assure good consolidation.

*Specifier Note: Do not use any form of battery or impressed current in association with the Sika 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 Sika FerroGard® anode and the reinforcing steel. Do not apply corrosion inhibitors directly on the Sika FerroGard® anode body or connecting wires, especially on or near the wire connection point with the reinforcing steel*.

* + - 1. APPLICATION OF SEALANTS
         1. Provide the approved sealant system where shown on the Drawings, and in strict accord with the manufacturer's recommendations as approved by the Architect.
         2. Install sealants immediately after joint preparation. Mix and apply multi-component sealants in accord with manufacturer's printed instructions.
         3. Install sealants to fill joints completely from the back, without voids or entrapped air, using proven techniques, proper nozzles and sufficient force that result in sealants directly contacting and fully wetting joint surfaces.
         4. Install sealants to uniform cross-sectional shapes with depths relative to joint widths that allow optimum sealant movement capability as recommended by sealant manufacturer.
         5. Tool sealants in manner that forces sealant against back of joint, ensures firm, full contact at joint interfaces and leaves a finish that is smooth, uniform and free of ridges, wrinkles, sags, air pockets and embedded impurities.
         6. Remove sealant from adjacent surfaces in accord with sealant and substrate manufacturer recommendations as work progresses.
         7. Protect joint sealants from contact with contaminating substances and from damages. Cut out, remove and replace contaminated or damaged sealants, immediately, so that they are without contamination or damage at time of substantial completion.
      2. FIELD QUALITY CONTROL
         1. Notify Architect when sections of work are complete to allow review prior to covering completed Work.
         2. Cooperate with Owner’s inspection agency as applicable, who will observe substrate and coating installation and provide written documentation of observations.
      3. CLEANING
         1. Remove uncured materials from tools or other surfaces with an approved solvent.
         2. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.
      4. PROTECTION
         1. Cap and protect exposed back-up walls against moisture and wet weather conditions during and after application of membrane. Protect Work against wet weather conditions for a minimum of 24 hours.

END OF SECTION

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