

## Discrete Cathodic Protection Anodes for Reinforced Concrete Structures and Steel Framed Buildings

### Description

Ebonex is a discrete Impressed Current Cathodic Protection (ICCP) anode, specifically designed to protect steel elements in concrete and steel-framed structures from corrosion. The anode utilises an innovative ceramic/titanium composite combined with an integral gas venting system. The system includes Ebofix grout, which is a high density, acid buffering grout used for long-term performance.

Ebonex anodes are available in a range of sizes, which provide excellent design flexibility. Ebonex discrete anodes are capable of exceeding the performance necessary to deliver the 100mV potential shift required for Cathodic Protection as specified under National Association of Corrosion Engineers (NACE) RP0290 & the European Standard EN12696 - Cathodic Protection of Steel in Concrete.

### Typical applications

- Bridges piers
- Columns and Beams
- Steel-Framed Buildings
- Tunnels
- Car-Parks
- Slab Joints

### Advantages

- **Porous ceramic** - allows the passage of anodic gases away from the anode surface. Preventing Cathodic Blocking.
- **Gas venting** - no build-up of anodic gases and therefore can be installed under strengthening systems, membranes and coatings.
- **Discrete installation** - no added dead weight loading or increase to physical dimensions of structure.
- **Long lasting** - longest life expectancy of any discrete CP anode - in excess of 40 years, depending upon design.
- **Highest level of protection** - fulfils the 100mV criteria for effective cathodic protection.
- **Cost competitive** - compared with other types of CP installations.
- **Deep installation** - protects steel in difficult to access areas.
- **High operating current** - suitable for use in areas of high steel density.
- **Versatile** - can be used in many sectors within the construction industry.
- **Flexible** - available in a wide number of sizes to provide maximum design flexibility.

### How does it work?

Ebonex works by distributing sufficient electrical current to overcome ongoing corrosion in the structure. The Ebonex anodes are connected to an external DC power supply, which provides the electrical current that mitigates corrosion activity. According to industrial standards, an ICCP system is



Level of protection	Description	Ebonex
Cathodic Prevention	Preventing new corrosion activity from initiating	✓
Corrosion Control	Significantly reduce ongoing corrosion activity	✓
Cathodic Protection	Highest level of protection, intended to stop ongoing corrosion	✓

considered effective when the steel is sufficiently polarised to result in a 100mV depolarisation after 4 - 24 hr, once the system has been turned off.

### Design criteria

Ebonex is a discrete Cathodic Protection anode system providing long-term durability to both new and existing structures and may be used even under highly aggressive conditions.

In line with other cathodic protection systems, Ebonex discrete anode systems must be designed by corrosion specialists and installed by approved contractors.

### Standards compliance

Ebonex discrete anodes are capable of exceeding the performance necessary to deliver the 100mV potential shift required for effective Cathodic Protection as specified under NACE (National Association of Corrosion Engineers) Standard RP 0290 & the European Standard EN12696-Cathodic Protection of Steel in Concrete.

# Ebonex®

The design of Ebonex discrete anodes follows comprehensive criteria established for the patented 'Ebonex' system, described in patent no PTC/GB99/00359, developed by Atraverda Ltd.

## Specification

Where indicated, Cathodic Protection to reinforced concrete elements/steel-framed buildings shall be provided by Ebonex discrete composite anodes capable of maintaining long-term stability at current densities of up to 900mA/m<sup>2</sup> (of anode surface), for the specified design life.

The discrete anodes shall be gas vented and fixed in place using Ebofix grout. A thixotropic, high density, acid buffering grout used for long-term performance.

All design, fixing and installation shall be carried out by specialists, experienced in the field of Cathodic Protection, approved by the anode system supplier.

## Sizing

Anode	Diameter x length (mm)	Current rating (mA)
CP07/100	7 x 100	2.0
CP10/100	10 x 100	2.8
CP10/150	10 x 150	4.2
CP18/100	18 x 100	5.1
CP18/200	18 x 200	10.2
CP18/300	18 x 300	15.2
CP28/100	28 x 100	7.9
CP28/300	28 x 300	23.7
CP28/600	28 x 600	47.5

## Application instructions

### Preparation

Ebonex discrete anodes are installed in pre-drilled holes 4 to 8mm larger than the nominal Ebonex discrete anode diameter and typically no further than 600mm apart (unless otherwise approved by the Engineer). The holes and Ebonex discrete anodes should be located to minimise their proximity to the steel reinforcement in order to provide an even current distribution to the steel within the local vicinity.

Cut a chase with a minimum depth of 20mm and a width of 8mm into the concrete between the holes. This chase is used to accommodate the titanium feeder wire, inter-connecting the Ebonex anodes, and any gas discharge piping. A 3mm saw cut can be used if the venting pipes are not interconnected.

Prior to application the holes and chases should be blown or vacuum cleaned of all debris and pre-soaked with water.

## Mixing

Ebofix grout should be mixed using a Fosroc mixing paddle on a slow speed (400/500rpm) drill. Add between 3.0-4.0 litres of drinking water, (depending on required consistency), into a suitable mixing drum and add one full 10kg bag of Ebofix grout. Mix for three minutes until a smooth, even consistency is obtained.

## Installation

Remaining water should be removed from the hole and the Ebofix grout injected by hand pump to the rear of the hole to avoid air entrapment, ensuring sufficient is placed to cover the entire length of the active Ebonex discrete anode. The thixotropic nature of Ebofix grout will prevent significant flow from vertical and overhead holes. Wet each Ebonex anode with clean water, but do not immerse for more than 10 seconds, before gently inserting into the hole. Ensure the vent pipe is unobstructed and that sufficient tail wire remains exposed to enable connection with the feeder wire.

Place the Ebofix grout within 30 minutes of mixing to gain benefit of the expansion system and allow to cure for a minimum of 24 hours, without physical disturbance. When cured the open end of the gas vent network can be directed to a well-ventilated location. It is not recommended that the feeder wire be run within the vent tubing of the Ebonex anode.

Connect strings of Ebonex discrete anodes together as recommended by the CP design engineer using non-coated titanium feeder wire. All wire jointing requires the use of proprietary titanium metal crimps, secured using the appropriate Fosroc crimping tool. After connections have been made, continuity should be tested with a resistance meter. Any found to have a resistance >1 Ohm require re-crimping. When the integrity of the connection is established the tail of each Ebonex discrete anode can be gently bent, thus settling the wire into the chased groove.

The chase is filled with a pre-bagged Fosroc repair mortar or Ebofix grout and left for at least 4 days before connecting to the power system.

## Limitations

In chloride contaminated structures, particular attention should be paid to the control of driving voltage of systems, which should not result in potentials greater than 7V being applied to the titanium connecting wires. For further information consult the local Fosroc office.

Performance of the Ebonex discrete anode is dependent upon the correct design, installation and maintenance of the Cathodic Protection system.

## Estimating

### Supply

#### Ebonex discrete anode:

Ebonex discrete anode with 500mm tail wire (see sizing for Ebonex discrete anode diameter and length)

# Ebonex®

**Ebofix grout:**

Supplied in 10kg bags

**Wire pack:**

Titanium feeder wire 40m x 1.6/1.2mm diameter

**Crimping pack:**

80 titanium crimps

**Venting pack:**

20m PVC venting tube plus 40 connecting T-pieces

**Fosroc crimping tool:**

Crimping tool plus plattens

## Storage

Ebonex discrete anodes should be stored in dry conditions.

Ebofix grout has a shelf life of 12 months from the date of manufacture if kept in dry storage in the original unopened bags.

Ebofix grout should be stored in cool dry internal conditions. If stored at high temperatures and/or high humidity the shelf life may be reduced to less than 6 months.

## Precautions

### Health and safety

For further information refer to appropriate Product Safety Data Sheet.

### Fire

Ebonex discrete anodes and Ebofix grout are non-flammable.



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