

Mapeshield I

Pure zinc anodes coated with a special conductive paste, for galvanic cathodic protection against corrosion of reinforcement rods in new structures and in structures requiring repair



WHERE TO USE

Mapeshield I is particularly recommended for protecting reinforcement rods against corrosion in structures of art requiring repair work and also offers a number of advantages if applied on new reinforced structures for protection against corrosion, especially if they come into contact with aggressive agents.

Application examples

- Piles and abutments on bridges and viaducts.
- Floor slabs.
- Pre-fabricated reinforced concrete structures.
- Front edges of balconies.
- Concrete floors (such as car-parks).
- Foundations.
- Basins.
- Prefabricated structures (buffer panels, beams, etc.).

TECHNICAL CHARACTERISTICS

Mapeshield I is made up of a multi-layered zinc core with a large surface area, covered with a special conductive paste which keeps the system active over the years. After connecting **Mapeshield I** to the reinforcement rods with metallic stays, a difference in potential is created between the steel and the zinc which stops corrosion and impedes its formation, even if the surrounding environment is particularly aggressive, for example due to the presence of chlorides. In fact, when two different metals are connected together in a suitable electrolyte (in this case the concrete), the metal with the most negative potential (the zinc) will corrode, while the metal with the least negative potential (steel reinforcement rods) remains protected against

corrosion. Also, the current generated provokes an increase in the pH level which leads to a slow re-alkalisation of the concrete and, if chloride ions are present, pushes them away. The degree of protection depends on the density of the reinforcement in the structure. The number of anodes applied varies according to whether the structure is highly reinforced or with only a small amount of reinforcement, or whether the structure is new or an old structure requiring repair. This calculation must be carried out using the attached graphs which indicate the reinforcement/concrete ratio and the pitch between each anode.

Mapeshield I is available in two different lengths and 4 different masses so the system may be used in most structures. The surface which the anode is capable of protecting depends on its size (the bigger the anode, the larger the area it protects) while the mass, which is proportional to the amount of metal it contains, effects its duration. **Mapeshield I** ensures that the steel reinforcement is depolarised in compliance with the prescriptions in the EN 12696 European standard "Cathodic protection of steel in concrete".

RECOMMENDATIONS

- **Mapeshield I** may not be applied where there is structural damage to the reinforcement. In such cases, the reinforcement must be integrated or replaced according to calculations carried out by a specialised technician.
- When the use of **Mapeshield I** is planned, do not apply **Mapofer**, **Mapofer 1K** or any other type of anti-rust protection on the reinforcement rods.

Mapeshield I



Mapeshield I applied to a viaduct pile under repair



Mapeshield I applied to the reinforcement of a flyover pile



Mapeshield I welded to the reinforcement of a new beam in the construction of a dockyard quay

TECHNICAL DATA (typical values)

MAPESHIELD I 30	U.M.	30/10	30/20
External surface	mm	300 x 50 ± 5%	300 x 50 ± 5%
Height	mm	10 ± 10%	12 ± 10%
Total weight	g	450 ± 10%	570 ± 10%
Mass of zinc	g	340 ± 2%	450 ± 2%
Outside colour	–	light blue	light blue
Packaging	–	vacuum-packed	vacuum-packed
MAPESHIELD I 10	U.M.	10/10	10/20
External surface	mm	100 x 50 ± 10%	100 x 50 ± 10%
Height	mm	12 ± 10%	15 ± 10%
Total weight	g	230 ± 10%	320 ± 10%
Mass of zinc	g	168 ± 2%	245 ± 2%
Outside colour	–	light blue	light blue
Packaging	–	vacuum-packed	vacuum-packed

• Do not use epoxy or polyurethane mortar, or mortar reinforced with metal fibres, to carry out repair work.

• If repair work is required, we recommend the use of a compensated-shrinkage mortar according to UNI EN 1504-3 standards with a maximum resistivity of 100 kΩ*cm.

APPLICATION PROCEDURE

Structures which require repairing

Preparation of the substrate

Prepare the substrate by removing the deteriorated and detached concrete, including from below the reinforcement rods, until a solid, strong substrate with a rough surface is obtained. Any areas previously repaired and which are not perfectly bonded must also be removed. All corrosion and loose particles must be removed from the reinforcement rods to guarantee that there is good contact between the steel and the repair mortar or concrete. The continuity of

the reinforcement rods must be checked with an ohmmeter before installing the protection.

How to choose the anode and the pitch required

Three main factors must be considered when choosing the most suitable anode:

- the shape of the structure;
- the size of the structure;
- duration of the passivity of the reinforcement rods to be guaranteed under all conditions, including in the presence of chlorides or cracks.

Mapeshield I is available in 4 different configurations:

- Mapeshield I 10/10
- Mapeshield I 10/20
- Mapeshield I 30/10
- Mapeshield I 30/20

Where the first number indicates its length (10 and 30 cm) and the second number its duration (10 and 20 years) according to the structure under repair and the mass of the anode.

or example, on a heavily-reinforced structure requiring repair (steel/concrete ratio = 0.8-1) with 30 cm long anodes and a service life of 20 years (**Mapeshield I 30/20**), according to table 2 the number of anodes required to protect the surface is 3 per square metre.

Application of the anodes

The anodes must be positioned and fastened firmly in place to the reinforcement rods so that they do not move during repair and casting operations. They must be attached to the reinforcement rods with the metallic fasteners supplied with the anodes using wire or by welding. Enough space must be left under the anodes to allow the mortar to penetrate when repairs are carried out. This space must never be less than 2-3 times the size of the largest aggregate in the repair mortar. Once installed, the continuity between the anodes and reinforcement rods must be checked with an ohmmeter.

Application of the repair mortar

The electrical resistivity of the repair mortar must be in a range of between 50% and 200% of the original concrete and up to a maximum of 100 kΩ, as specified in EN 12696 standards. Mortars from the **Mapegrout** range comply with the requirements and are therefore recommended for repairing structures protected with galvanic cathodic systems. Carry out repairs following normal application guidelines, according to the product chosen and the indications on the data sheet of the mortar used for the repairs. When applying the mortar, do not leave any gaps around the anodes.

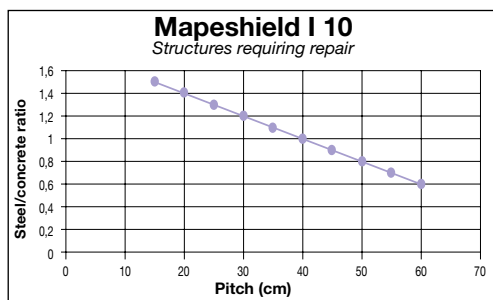


Table 1

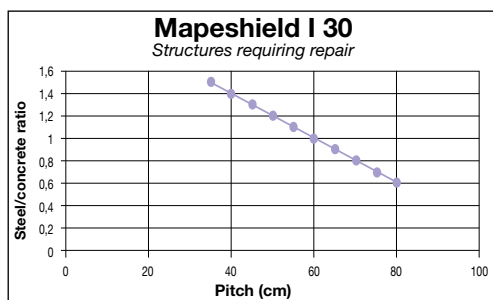


Table 2

New structures

Mapeshield I may be used on new structures even if they are located in particularly aggressive environments. If the system is placed on the reinforcement rods, complete passivity is guaranteed.

Even if the concrete used has been made according to EN 206, UNI 11104 or Eurocode 2 standards, cracks may appear over the years due to shrinkage following incorrect curing procedures or the continuous external stresses to which it is subject (vibration, dynamic loads, impact etc.). Water, oxygen, carbon dioxide and chlorides may then penetrate into the cracks and corrode the reinforcement rods. A galvanic cathodic protection system installed correctly in the concrete considerably increases the duration of the structure, by delaying problems caused by unforeseen defects for a number of years.

To protect new structures, fewer anodes are required compared with repaired structures and they have a much higher duration. This is due to the fact that, on new structures, the reinforcement rods are passive and so the current required to keep them protected is minimal.

For example, in a new highly-reinforced structure (steel/concrete ratio = 0.8-1) two **Mapeshield I 10/20** anodes every square metre (see table 3) offer protection against corrosion for approximately 40 years, and when the anodes are completely consumed the reinforcement rods will still be passive.

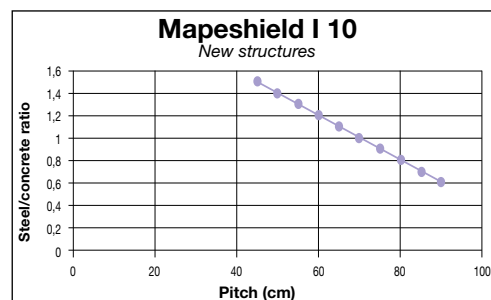


Table 3

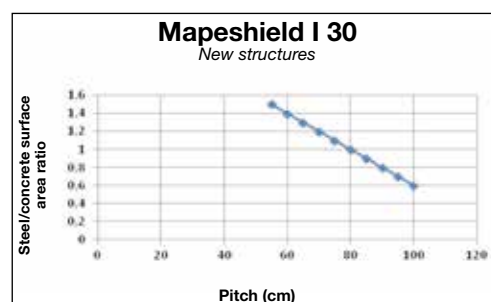


Table 4

Functional checks

In order to check the system, several reference electrodes (in Ag/AgCl for example) must be embedded in the concrete when it is cast or applied in the area protected by the anodes which are to be monitored. Several anodes in critical areas are connected to cables with an on/off switch and then connected with the cables from the reference anodes to an external switch box.



Construction of a new central reservation protected with Mapeshield I



Pouring concrete for a structure protected with Mapeshield I

Mapeshield I



The procedure for the functional checks is described in the EN 12696 standard which states:

- depolarisation during the 24 hours after switching off of at least 100 mV compared to the potential measured between 0.1 and 1 second after disconnecting the anode (instant off);
- depolarisation over a longer period (> 24 hours) of at least 150 mV after instant off.

Mapeshield I complies with the above criteria.

PRECAUTIONS TO BE TAKEN DURING AND AFTER APPLICATION

No special precautions need to be taken if the temperature is between +5°C and +35°C.

CONSUMPTION

See attached graphs.

PACKAGING

Mapeshield I 30/10 and 30/20 in boxes of 12.
Mapeshield I 10/10 and 10/20 in boxes of 24.

STORAGE

Mapeshield I may be stored for up to 24 months in its original packaging in a dry place.

SAFETY INSTRUCTIONS FOR PREPARATION AND APPLICATION

Mapeshield I is an article and referring to the current European regulations (Reg. 1906/2007/CE - REACH) does not require the preparation of the material Safety Data Sheet. During use it is recommended to wear protective gloves and goggles and follow the safety requirements of the workplace.

PRODUCT FOR PROFESSIONAL USE.

WARNING

Although the technical details and recommendations contained in this product data sheet correspond to the best of our knowledge and experience, all the above information must, in every case, be taken as merely indicative and subject to confirmation after long-term practical application: for this reason, anyone who intends to use the product must ensure beforehand that it is suitable for the envisaged application: in every case, the user alone is fully responsible for any consequences deriving from the use of the product.

Please refer to the current version of the Technical Data Sheet, available from our website www.mapei.com

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The most up-to-date TDS can be downloaded from our website www.mapei.com.

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All relevant references for the product are available upon request and from www.mapei.com