



# SLOVENSKI STANDARD SIST EN ISO 12696:2017

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Nadomešča:  
SIST EN ISO 12696:2012

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## Katodna zaščita jekla v betonu (ISO 12696:2016)

Cathodic protection of steel in concrete (ISO 12696:2016)

Kathodischer Korrosionsschutz von Stahl in Beton (ISO 12696:2016)

Protection cathodique de l'acier dans le béton (ISO 12696:2016)

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**Ta slovenski standard je istoveten z: EN ISO 12696:2016**

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77.060	Korozija kovin	Corrosion of metals
77.140.15	Jekla za armiranje betona	Steels for reinforcement of concrete
91.080.40	Betonske konstrukcije	Concrete structures

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## Cathodic protection of steel in concrete (ISO 12696:2016)

Protection cathodique de l'acier dans le béton (ISO  
12696:2016)Kathodischer Korrosionsschutz von Stahl in Beton (ISO  
12696:2016)

This European Standard was approved by CEN on 24 November 2016.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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## European foreword

This document (EN ISO 12696:2016) has been prepared by Technical Committee ISO/TC 156 "Corrosion of metals and alloys" in collaboration with Technical Committee CEN/TC 219 "Cathodic protection" the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2017, and conflicting national standards shall be withdrawn at the latest by June 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 12696:2012.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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**Cathodic protection of steel in  
concrete**

*Protection cathodique de l'acier dans le béton*

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

The committee responsible for this document is ISO/TC 156, *Corrosion of metals and alloys*.

This second edition cancels and replaces the first edition (ISO 12696:2012), of which it constitutes a minor revision with the following changes:

- figures for MnO<sub>2</sub>, NaOH (0,5 M) in [Table A.1](#) have been updated;
- general editorial corrections throughout the document.

## ISO 12696:2016(E)

### Introduction

This document applies to cathodic protection of steel in concrete, with the concrete atmospherically exposed, buried or immersed.

Because the criteria of protection for steel in buried or immersed concrete are those applicable to cathodic protection of steel in atmospherically exposed concrete, this revision of EN 12696:2000 incorporates cathodic protection of steel in buried and immersed concrete. The provision of cathodic protection current can often be more economically provided to steel in buried and immersed concrete by using buried or immersed anode systems detailed in International Standards for buried and immersed steel structures, rather than the anode systems that are suitable for applications to steel in atmospherically exposed concrete. Therefore, reference is made to other International Standards in this respect while the cathodic protection performance criteria for steel in concrete are defined in this document for all exposures.

There are other electrochemical treatments intended to provide corrosion control for steel in concrete. These techniques include re-alkalization and chloride extraction and are not incorporated into this document. CEN/TS 14038-1:2004 and CEN/TS 14038-2:2011 have been published.

Cathodic protection of steel in concrete is a technique that has been demonstrated to be successful in appropriate applications in providing cost effective long-term corrosion control for steel in concrete. It is a technique that requires specific design calculations and definition of installation procedures in order to be successfully implemented. This document does not represent a design code for cathodic protection of steel in concrete, but represents a performance standard for which it is anticipated, in order to comply with this document, a detailed design and specification for materials, installation, commissioning and operation will be prepared.

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# Cathodic protection of steel in concrete

## 1 Scope

This document specifies performance requirements for cathodic protection of steel in cement-based concrete, in both new and existing structures. It covers building and civil engineering structures, including normal reinforcement and prestressed reinforcement embedded in the concrete. It is applicable to uncoated steel reinforcement and to organic-coated steel reinforcement.

This document applies to steel embedded in atmospherically exposed, buried, immersed and tidal elements of buildings or structures.

NOTE 1 [Annex A](#) gives guidance on the principles of cathodic protection and its application to steel in concrete.

NOTE 2 This document, while not specifically intended to address cathodic protection of steel in any electrolyte except concrete, can be applied to cathodic protection of steel in other cementitious materials such as are found, for example, in early 20th century steel-framed masonry, brick and terracotta clad buildings. In such applications, additional considerations specific to these structures are required in respect of design, materials and installation of cathodic protection; however, the requirements of this document can be applied to these systems.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1504 (all parts), *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity*

EN 14629, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of chloride content in hardened concrete*

EN 14630, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of carbonation depth in hardened concrete by the phenolphthalein method*

IEC 60502-1, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV ( $U_m = 1,2$  kV) to 30 kV ( $U_m = 36$  kV) — Part 1: Cables for rated voltages of 1 kV ( $U_m = 1,2$  kV) and 3 kV ( $U_m = 3,6$  kV)*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61140, *Protection against electric shock — Common aspects for installation and equipment*

IEC 61558-1, *Safety of power transformers, power supplies, reactors and similar products — Part 1: General requirements and tests*

IEC 61558-2-1, *Safety of power transformers, power supplies, reactors and similar products — Part 2-1: Particular requirements and tests for separating transformers and power supplies incorporating separating transformers for general applications*

IEC 61558-2-2, *Safety of power transformers, power supplies, reactors and similar products — Part 2-2: Particular requirements and tests for control transformers and power supplies incorporating control transformers*

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IEC 61558-2-4, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V — Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers*

IEC 61558-2-13, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V — Part 2-13: Particular requirements and tests for auto transformers and power supply units incorporating auto transformers*

IEC 61558-2-16, *Safety of transformers, reactors, power supply units and similar products for voltages up to 1 100 V — Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

**3 Terms and definitions**

For the purposes of this document, the terms and definitions given in ISO 8044 and EN 1504 (all parts) and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

**3.1 zone**

part of a cathodic protection system

Note 1 to entry: Anode systems may be divided into separate zones to supply current to a fully continuous reinforcement mesh. Alternatively, a single anode zone may supply current to separate, electrically isolated, zones within the reinforcement system. Zones may comprise an individual anode zone for each reinforcement zone or exposure condition. As the current provision to each of the zones in each of these alternatives can be separately measured, all of them are generically called “cathodic protection zones” and specifically “anode zones” or “cathode zones”.

**3.2 humectant**

hygroscopic material, i.e. a substance that promotes the retention of moisture

Note 1 to entry: It may be applied to the surface of a galvanic anode to keep the concrete-anode interface moist.

**4 General****4.1 Quality management systems**

The design, the installation, the energizing, the commissioning and the long-term operation of all of the elements of cathodic protection systems for steel in concrete shall be fully documented.

NOTE ISO 9000 constitutes a suitable quality management systems standard which can be utilized.

Each element of the work shall be undertaken in accordance with a fully documented quality plan.

Each stage of the design shall be checked and the checking shall be documented.

Each stage of the installation, energizing, commissioning and operation shall be the subject of appropriate visual, mechanical and/or electrical testing, and all testing shall be documented.

All test instrumentation shall have valid calibration certificates traceable to national or European standards concerning calibration.

The documentation shall constitute part of the permanent records for the works.

## 4.2 Personnel

Each aspect of the cathodic protection system design, installation, testing of the installation, energizing, commissioning and long-term operational control shall be under the supervision of personnel with appropriate qualifications, training, expertise and experience in the particular element of the work for which they are responsible.

**NOTE** Cathodic protection of steel in concrete is a specialist multidiscipline activity. Expertise is required in the fields of electrochemistry, concrete technology, civil and/or structural engineering and cathodic protection engineering.

Personnel who undertake the design, supervision of installation, commissioning, supervision of operation, measurements, monitoring and supervision of maintenance of cathodic protection systems shall have the appropriate level of competence for the tasks undertaken. EN 15257 specifies a suitable method which may be utilized for assessing the competence of cathodic protection personnel.

The competence of cathodic protection personnel to the appropriate level for tasks undertaken should be demonstrated by certification in accordance with EN 15257 or by another equivalent prequalification procedure.

## 4.3 Design

This document does not represent a design code, but is a performance standard.

Cathodic protection systems for steel in concrete shall be the subject of detailed design.

The design shall, as a minimum, include the following:

- a) detailed calculations;
- b) detailed installation drawings;
- c) detailed material and equipment specifications;
- d) detailed method statements or specifications for installation, testing, energizing, commissioning and operation;
- e) structures containing prestressing shall be assessed for their susceptibility to hydrogen embrittlement and for risk of stray currents.

[Annex B](#) lists items that should be considered in the detailed design.

## 5 Structure assessment and repair

### 5.1 General

For cathodic protection (or cathodic prevention) of new structures, see [5.12](#).

The assessment of an existing structure, including its material condition, its structural integrity and whether and how to repair it, shall be performed in accordance with EN 1504 (all parts).

When cathodic protection is proposed as the repair/protection method, or part of it, for a structure, additional investigation shall be undertaken in order to

- a) confirm the suitability of cathodic protection, and
- b) provide system-design input information. See [Annex B](#).

These investigations shall include, but shall not be limited to, those in [5.2](#) to [5.10](#).