SLOVENSKI STANDARD
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Corrosion protection of metals - Non-electrolytically applied zinc flake coatings on iron or steel components

Corrosion protection of metals - Non-electrolytically applied zinc flake coatings on iron or steel components

Korrosionsschutz von Metallen - Nicht elektrolytisch aufgebrachte schuppenförmige Zinküberzüge auf Werkstücken aus Eisen oder Stahl

Protection des métaux contre la corrosion - Revetements non électrolytiques de lamelles de zinc sur des composants en fer ou en acier

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Contents

Page

Foreword

This document (EN 13858:2003) has been prepared by Technical Committee CEN/TC 262 “Metallic and other inorganic coatings”, 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of an identical text or by endorsement, at the latest by February 2004, and conflicting national standards shall be withdrawn at the latest by February 2004.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

The purpose of non-electrolytically applied zinc flake coatings (which may contain a small proportion of aluminium flakes) is for the improvement of corrosion protection of steel components. These coatings can also incorporate an integral lubricant, for the improvement of lubricity, if required.

The non-electrolytically applied zinc flake coatings for iron and steel components can be obtained by cold immersion or by pneumatic or electrostatic gun-spraying of the coating liquid, followed by curing. These coatings may also contain a certain proportion of aluminium flakes. There is no risk of hydrogen embrittlement associated with the coating process and the subsequent curing treatment. Coating processes by cold immersion ensure complete coverage of components, even with complex shapes.

The coatings give cathodic protection to steel under normal atmospheric conditions.

The efficiency of a zinc flake based coating for corrosion protection depends on its thickness and on the type of corrosive environment to which it is exposed.

The results of accelerated corrosion tests, like the neutral salt spray test, have no direct correlation with the corrosion protection in other environments.

Variations in colour or lubricity can be obtained by applying a suitable supplementary coat to zinc flake based coatings.

WARNING — When welding zinc flake coated articles, ensure adequate ventilation is provided in order to evacuate fumes from the welding area.

1 Scope

This European Standard describes the characteristics of and specifies requirements for non-electrolytically applied coatings, composed mainly of zinc flakes, for the protection against corrosion of steel components, excluding threaded fasteners for which another specification exists (see prEN ISO 10683).

It specifies minimum corrosion resistance to the neutral salt spray test in accordance with ISO 9227 when applied to steel components.

The coatings can be supplied with integral lubricant if specified.

The application processes used for zinc flake coatings do not induce hydrogen embrittlement. For this reason, these coatings are specifically recommended for the protection of high strength steel components ($R_m \geq 1\,000$ MPa).

The time and temperature used for the curing of the coating can influence the mechanical characteristics of certain components due to their metallurgical condition.

NOTE These coatings should not be applied to components that can be used at temperatures higher than the curing temperature of the coating, unless specifically ordered.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN ISO 1463, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method (ISO 1463:1982)*.

EN ISO 2064:2000,*Metallic and other inorganic coatings – Definitions and conventions concerning the measurement of thickness (ISO 2064:1996)*.

EN ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method (ISO 2178:1982)*.

EN ISO 3882, *Metallic and other inorganic coatings — Review of methods of measurement of thickness (ISO 3882:2003)*.

ISO 8991, *Designation system for fasteners*.

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN ISO 2064:2000 apply. In particular:

3.1
significant surface
part of the article covered or to be covered by the coating, and for which the coating is essential for serviceability and/or appearance and where the coating shall meet all the requirements

[EN ISO 2064:2000]

4 Types of coating and application

4.1 Surface cleaning and preparation

Components of tensile strength of 1 000 MPa and above that have been extensively cold worked shall be stress relieved before cleaning.

Any surface film present on the components before coating, e.g. rust or scale, shall be removed before processing. This can be undertaken by using chemical or mechanical means. Before the application process, the components shall be clean and dry.

NOTE Mechanical cleaning is preferred for steel parts having a tensile strength of 1 000 MPa and above to avoid the risk of hydrogen embrittlement.

4.2 Type of coating

The coating is produced by applying to the surface of a component a zinc flake dispersion, possibly with addition of aluminium flakes, in a suitable liquid medium, which under influence of heat (curing), generates a bonding of the flakes and between flakes and substrate, thus forming an electrically conducting inorganic surface coating that ensures cathodic protection. It may or may not contain chromate.

The coating shall be completely dry.

4.3 Coating processes

Two types of coating process are generally in use:

a) immersion in cold coating liquid, followed by draining or spinning, to eliminate excess material (components can be coated on racks or in bulk);

b) pneumatic or electrostatic gun spraying (this method allows selective coating if required).

These processes and their parameters shall be adapted according to the geometry of the components in order to obtain the required characteristics.

4.4 Curing

The curing temperatures and curing times shall be as required for the composition of the coating material.

NOTE The temperatures are generally within the range 180 °C to 310 °C. The curing time is normally between 15 min and 60 min.

For certain types of component, the physical or metallurgical characteristics can be affected by curing at too high temperatures or for too long a time. If this risk exists, tests shall be carried out in order to determine the most appropriate application parameters.

5 Properties of non-electrolytically applied coatings

5.1 Corrosion protection

5.1.1 Protection mechanism

The protection mechanism consists of the following:

a) barrier protection provided by the bonded layers of flakes;

b) cathodic protection from the zinc or aluminium flakes;

c) the passivation of zinc flakes throughout the coating, which decreases the rate of zinc oxidation and increases the protection in most climatic conditions and delays the formation of zinc corrosion products.

NOTE 1 The duration of the protection against atmospheric corrosion is increased with greater coating thickness, and also depends upon the particular conditions of use and climate. In view of the wide variety of conditions of use that can be encountered, specific controlled climatic and chemical reagent tests can be desirable in order to determine the most appropriate coating grade (see Table 1).

NOTE 2 Regarding contact corrosion, zinc flake coatings behave, in most cases, in bimetallic contacts like other types of zinc coating. The materials that can cause an adverse effect on the coating are, for example, graphite, chromium, stainless steel, copper, tin, lead and other "noble" metals. Contact metals that normally cause no adverse effects are aluminium and zinc (including zinc-coated components). To moderate or avoid any adverse effects, an insulating coating or layer can be applied over the non-electrolytically applied zinc flake coatings.

5.1.2 Supplementary coatings

The non-electrolytically applied zinc flake coatings can be covered by paints (conventional and electrophoretic), lacquers and lubricants. The duration of the corrosion protection may then be longer than for the zinc flake coating alone.

Paint adhesion tests can indicate some lamination of the zinc-flake coating but this does not normally represent typical service performance.

5.2 Ductility

The ductility of the non-electrolytically applied zinc flake coatings is sufficient to ensure acceptable performance of components such as coil springs and spring clips and other components where elastic movements occur in service.

The ductility is not usually sufficient if plastic deformation of the basis material takes place after coating.

5.3 Electrical conductivity

Non-electrolytically applied zinc flake coatings are electrically conductive but to a lesser degree than electroplated zinc coatings. If necessary, the conductivity can be measured by a method relevant to the coated part and its service requirements.