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Thermal spraying — Coatings for protection against corrosion and oxidation at elevated temperatures

Projection thermique — Revêtements de protection contre la corrosion et l'oxydation à haute température

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 17834 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

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Foreword

This document EN ISO 17834:2003 has been prepared by Technical Committee CEN/TC 240 “Thermal spraying and thermally sprayed coatings”, the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 107 “Metallic and other inorganic coatings”.

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of an identical text or by endorsement, at the latest by June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

Annex A is informative. Annex B is normative.

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.

1 Scope

This standard is applicable to sprayed metal coatings for protection against corrosion at temperatures up to 1000°C (1273 K).

For the protection of iron and steel by sprayed aluminium and zinc coatings against atmospheric corrosion reference should be made to prEN ISO 2063.

Coating materials other than metals, although they may be applied by spraying, are outside the scope of this standard.

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 1274, *Thermal spraying — Powders — Composition — Technical supply conditions.*

EN 13507, *Thermal spraying — Pre-treatment of surfaces of metallic parts and components for thermal spraying.*

prEN ISO 2063, *Thermal spraying — Metallic and other inorganic coatings — Zinc, aluminium and their alloys (ISO/DIS 2063:2002).*

EN ISO 14919, *Thermal spraying — Wires, rods and cords for flame and arc spraying — Classification — Technical supply conditions (ISO 14919:2001).*

ISO 14232, *Thermal spraying — Powders — Composition and technical supply conditions.*

3 Coating material and processes

When selecting coating materials and processes, consideration shall be given to the different working temperatures and operating environments that may be found.

For example in any temperature range a coating may be required to resist:

— oxidation;

— other chemical attacks or;

— a combination of oxidation and other chemical attacks.

Typical coating materials will include the following:

— nickel/chromium alloys;

— iron/chromium/aluminium alloys;

— metal/chromium/aluminium/yttrium alloys.

NOTE The metal can be nickel, cobalt, iron or alloys of these.

Other inert wear resistant materials such as chromium carbide, may be blended with these alloys to provide a combination of properties.

When selecting coating materials, the following reactants and their effects either individually or when combined shall be considered:

— oxygen;

— sulphur;

— chlorine;

— vanadium;

— potassium;

— sodium.

Taking each of these in turn, the following points shall be considered:

a) depending upon the presence or absence of oxygen, the corrosion characteristic can change significantly. Purely oxidising conditions indicate the use of aluminium alone;

b) where high sulphur contents (mass fraction > 0,5 %) are present, the use of iron based alloys is recommended rather than nickel based unless their chromium content is a mass fraction > 30 %;

c) where high chlorine contents (mass fraction > 0,5 %) are present, the use of nickel based alloys is recommended rather than iron based unless their chromium content is a mass fraction > 30 %;

d) molten salts such as sodium or potassium vanadate require the addition of chromium to iron based materials. The chromium content shall be a mass fraction > 25 % and the aluminium content a mass fraction > 0,5 %;

e) generally coating thicknesses of 0,2 mm shall be considered for aluminium and 0,4 mm for other materials.

With regard to the choice of process, the oxidation resistance of chromium bearing alloys is inversely related to the amount of chromium lost to oxide formed during the spraying process and the level of porosity. Therefore processes that create lower oxide and porosity levels will tend to perform better than others. Nevertheless this should be balanced against the fitness for purpose of the coating and economic factors.

4 Application of coating

The coating shall be applied to the clean and dry surface, prepared in accordance with EN 13507.

The sprayed coating shall be applied as soon as possible after surface preparation and before visible deterioration of the surface has occurred. If in comparison with a freshly prepared surface of material of similar quality visible deterioration has occurred, the surface preparation shall be repeated. In no case shall delay between surface preparation and coating application exceed 4 h unless special precautions, agreed between manufacturer and purchaser, are taken to ensure a suitably controlled storage atmosphere.

NOTE An initial thin coating of the sprayed metal can be applied to preserve the prepared surface; the requirements of clause 6 would then apply.

The surface of the sprayed coating shall be of uniform texture free from lumps, coarse areas and loosely adherent particles.

Contamination or corrosion of the sprayed coating shall be avoided at all stages during the application of the coating and the coating shall be maintained in a dry and clean condition until any subsequent treatment according to the requirements of clause 5 has been applied.

Table 1 — Coatings requirements and treatments for classes of service conditions

Class	Service	Sprayed coating		Subsequent treatment
	Temperature[a] and environment	Coating material (see annex B)	Nominal coating thickness mm	Intermediate/final treatment
A[b]	350°C to 550°C Oxidising	1,2	> 0,2	may be sealed with silicone sealer
B[b]	350°C to 900°C Oxidising	2	> 0,2	may be sealed with silicone sealer
C	Up to 1000°C (in absence of sulphurous gases or chlorine or molten salts)	3,4,5	> 0,4	—
D	Up to 1000°C (in presence of sulphurous gases but not chlorine)	4,5	> 0,4	—
E	Up to 1000°C (in presence of sulphurous gases and chlorine)	5	> 0,4	—
F	For complex severe corrosion conditions	6	> 0,1	may be diffusion heat treated in inert atmosphere

[a] Provided it is realised that the service life will be affected, higher temperatures than those quoted may be tolerated. The reduction in service life will depend on the duration of the higher temperatures.

[b] At temperatures below 350°C in purely oxidising conditions the choice of coating material is not critical.