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Metallic and other inorganic coatings — Guidelines for specifying metallic and inorganic coatings

Revêtements métalliques et autres revêtements inorganiques — Lignes directrices pour spécifier des revêtements métalliques et inorganiques

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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.

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 27830 was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, Subcommittee SC 3, *Electrodeposited coatings and related finishes*.

Introduction

This International Standard specifies the technical requirements of metallic and other inorganic coatings in order to develop consistent technical standards, facilitate the understanding of technical requirements and ensure a standard format.

This International Standard provides guidance to those involved in the drafting of technical standards and assistance to users, purchasers and processors on interpreting the International Standards that specify metallic and other inorganic coatings.

Metallic and other inorganic coatings — Guidelines for specifying metallic and inorganic coatings

1 Scope

This International Standard specifies the technical requirements of metallic and other inorganic coatings in order to develop consistent technical standards and establishes a standard format for designating the coatings. It applies to International Standards for electrodeposited, autocatalytic and vapour deposited coatings.

Detailed technical requirements for individual coatings are not given in this International Standard, but can be found in the International Standards listed in the Bibliography.

This International Standard does not apply to thermally sprayed and porcelain enamel coatings.

This International Standard is not to be specified in technical standards, product specifications, contracts, purchase orders or on engineering drawings, as invoking a "method of specifying" in these documents is not contractually binding.

The main clauses of a *coating* standard shall be the following:

Introduction (optional)

1. Scope (mandatory)
2. Normative references (mandatory)
3. Terms and definitions (mandatory)
4. Information to be supplied to the electroplater or processor by the purchaser (mandatory)
5. Designation (mandatory)
6. Requirements (mandatory)
7. Sampling (mandatory)

Annexes A, B, C …etc. (optional)

Bibliography (*optional*)

The Scope shall define the purpose of the standard and state the materials and products to which it applies, along with any known limitations. The Scope also contains warnings or caveats concerning health and safety hazards, international and environmental rules and regulations in bold font e.g.:

WARNING — This International Standard might not be compliant with some countries' health, safety and environmental legislations and calls for the use of substances and/or procedures that might be injurious to health if adequate safety measures are not taken. This International Standard does not address any health hazards, safety or environmental matters and legislations associated with its use. It is the responsibility of the user of this International Standard to establish appropriate health, safety and environmentally acceptable practices and take appropriate action to comply with any national, regional and/or International regulations.

Compliance with this International Standard does not of itself confer immunity from legal obligations.

2 Normative references

This clause shall begin with a standard introductory paragraph provided by ISO. The current wording of the introductory paragraph is as follows:

"The following referenced documents are indispensable for the application 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."

This introductory paragraph is followed by a complete list of the International Standards cited within the document, which are necessary for determining that the requirements of the standard have been met. The list is arranged in ascending order according to the International Standard number.

The normative references are most often International Standards, but national and regional standards may be cited at the end of the list, if necessary.

3 Terms and definitions

References to International Standards that define the terminology and conventions established for metallic and inorganic coatings are included in this clause. The standards cited shall be included in Clause 2.

This clause may also include terms that are not defined in existing standards and that are unique to a specific coating standard, e.g.:

"For the purposes of this document, the following terms and definitions apply/the terms and definitions given in … and the following apply."

4 Information to be supplied to the electroplater (or processor) by the purchaser

4.1 Essential information

The purchaser shall provide the essential information requested in this sub-clause, in writing, as part of the contract, purchase order, detailed product specification and/or on engineering drawings.

The essential information shall include the following items with cross-references, in parentheses, to the clauses and sub-clauses that provide further details about the requirements and test methods.

a) The number of the International Standard and the designation as specified in the International Standard (see Clause 5);

b) The appearance required, for example, bright, dull, satin, preferably with samples of the required finish (see Clause 6);

c) The significant surface indicated by drawings or by suitably marked specimens (see Clause 6);

d) The nature, condition and finish of the basis material, if they affect serviceability and/or the appearance of the coating (see Clause 6);

e) The position on the surface for unavoidable defects, such as rack or contact marks (see Clause 6);

f) The requirements for heat treatment before and/or after coating (see Clause 6);

g) The standards for determining that thickness, corrosion, adhesion, porosity and other requirements have been met (see Clause 6);

h) Sampling methods, acceptance levels and inspection requirements for quality control purposes (see Clause 7).

Subclause 4.1 shall appear in all coating documents. The above items shall be listed in the order in which they are cited in Clause 6.

4.2 Additional information

This sub-clause shall itemize additional information, not included in 4.1, that may be required for a particular coating, product or application.

It may include special requirements for the preparation of surfaces prior to coating, for the recovery of rejects, for roughness of the final finish and for any other requirements appropriate for a particular coating, product or application.

5 Designation

5.1 General

5.1.1 Designation specification

The designation system defined in ISO Directives is comprised of the description unit or module, the International Standard number unit or module and the individual item unit or module as shown in Figure 1. The International Standard number module shall be separated from the individual item module by a hyphen.

The designation consists of characters that shall be letters, digits or signs. The only signs permitted are the hyphen (-), the solidus (/), and the comma (,). In the case of metallic and organic coatings, the use of parentheses shall be allowed in the individual item block or module for clarity.

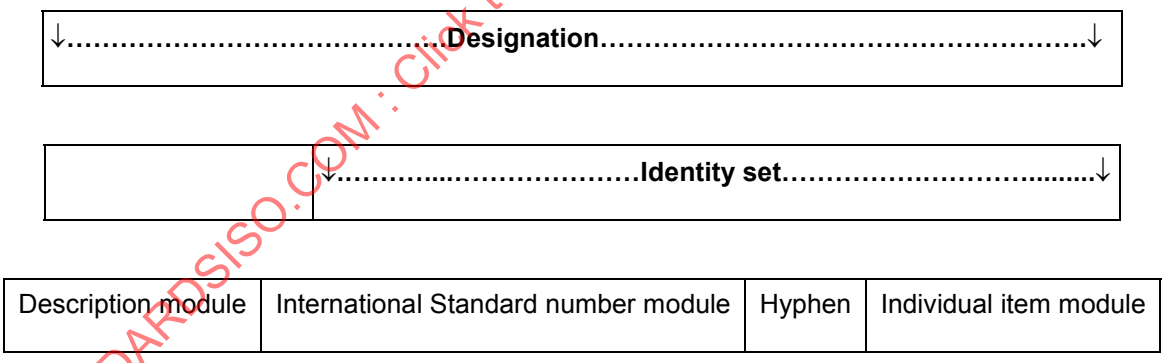

Figure 1 — Components of the designation system

5.1.2 Description and International Standard number modules

The description module briefly describes the designated coating. The following description module shall be used to designate the coatings within the scope of ISO/TC 107:

a) electrodeposited coating;

b) autocatalytic coating;

c) vapour deposited coating.

The description module shall be followed by the number of the International Standard of the particular coating that is being designated; for example, ISO 1456[1], ISO 2081[4], ISO 4527[11], etc.

The identity set is comprised of the International Standard number module plus the individual item module, both being essential for designating coating requirements.

5.1.3 Individual item module

The individual item module designates the following items:

a) the basis material (see 5.2);

b) the specific alloy (optional) (see 5.2);

c) stress relief requirements, when necessary (see 5.3);

d) the type and thickness of undercoats, when present (see 5.4);

e) the coating and its minimum local thickness (see 5.4);

f) the type of coating (see 5.4);

g) the type and thickness of coatings applied over the designated coating, if present (see 5.4);

h) post-treatments including heat treatment, when necessary (see 5.3).

Each of these steps in the coating sequence is separated by a solidus (/). Double separators or solidi indicate that a step in the process is either not required or has been omitted.

5.2 Designation of the basis material

5.2.1 The basis metal shall be designated by its chemical symbol, or by that of the principal constituent in the case of an alloy. In the case of plastics and non-metallic materials, appropriate symbols have been established.

See Table A.1 for the symbols that are commonly used.

5.2.2 It is recommended (optional) that the specific alloy be designated by its standard designation. References to national or local systems for identifying the specific alloy have been included in some existing International Standards for metallic coatings. The standard designation for the alloy, in parentheses, may be inserted after the symbol for the basis material. For example, Fe(G43400) identifies an alloy according to the UNS system established by ASTM[17].

The standard designation for the basis material is useful for selecting the method of surface preparation and for identifying alloys that may be susceptible to hydrogen embrittlement.

5.3 Designation of heat treatment requirements

The heat treatment requirements shall be designated as follows:

a) the letters SR for heat treatment for stress relief purposes (ISO 9587[13]), the letters HR for hydrogen embrittlement relief heat treatment (ISO 9588[14]), or the letters HT for heat treatment for other purposes (e.g. to increase adhesion or to increase the ductility of the coating);

b) in parentheses, the minimum temperature, in degrees centigrade;

c) the duration of the heat treatment, in hours.

EXAMPLE A stress relief heat treatment at 210 °C for 2 h is designated as follows:

SR (210)2

5.4 Designation of the type and thickness of the coatings

a) The coatings shall be designated by the symbols given in Table A.2, followed by a number designating the minimum local thickness of the coating in micrometres.

b) In the case of a binary alloy coating, the symbol shall be followed by a whole number, in parentheses, giving the nominal content of the alloying element in percent mass fraction. For example, NiP(10)15 designates an autocatalytic nickel-phosphorus alloy coating that is 15 µm thick containing 10 % mass fraction phosphorus.

c) Metallic undercoats, when present, shall be designated by the chemical symbol(s) for the deposited metal(s) followed by a number specifying the minimum local thickness of the layer, in micrometres. See Table A.3 for the symbols of some common metallic undercoats.

d) Subsequent metallic coatings (top coats), e.g. chromium or gold electrodeposited upon the specified coating, shall be designated by the chemical symbols given in Table A.2.

e) The different types of coatings shall be designated by the lower case letters given in Table A.4.

f) Chemical conversion coatings and supplementary treatments (for example, those commonly used with zinc and cadmium coatings) shall be designated by the symbols in Table A.5 and Table A.6.

5.5 Examples of designations

International Standards for metallic and other inorganic coatings shall provide specific examples to assist the user of the International Standard in understanding the designation system.

Examples of designations are given in Annex B.

6 Requirements

This clause shall give the requirements for appearance, heat treatment, thickness, adhesion, corrosion resistance and porosity (see 4.1), as well as for special requirements (see 4.2) and specify the test methods that shall be used to determine that the requirements have been met.

The coating thickness that is specified in the designation is the minimum local thickness which shall be measured at any point on the significant surface that can be touched by a ball 20 mm in diameter. The definitions and conventions for thickness are given in ISO 2064[2].

Thickness is an important dimension of the coating because thickness directly affects corrosion performance and the useful service life of the final product. Many of the standards on metallic and other inorganic coatings specify the minimum local thickness as related to different conditions of service. In general, corrosion performance improves as thickness is increased and the recommended minimum coating thickness is thus greater for severe service conditions than for mild ones. The severity of different service conditions has been standardized and is described in Annex C.

7 Sampling

This clause usually refers to ISO 4519[7] which provides sampling plans for inspection, but ISO 2859[6] may also be useful. The sampling plans are used to determine the number of measurements that shall be made for a given lot to verify that the technical requirements of the standard have been met.

8 Annexes and Bibliography

Annexes are optional and are placed at the end of the International Standard in alphabetical order. Informative annexes provide background and other ancillary facts that are not requirements of the standard. Normative annexes contain technical requirements and give test methods that are an integral part of the specification. References that are not normative are to be included in a separate section following the annexes.

Annex A
(normative)

Symbols for designating metallic and other inorganic coatings

A.1 Basis materials

Table A.1 — Symbols for basis materials

Basis material symbol	Description of basis material
Fe	Iron or steel
Zn	Zinc or zinc alloys
Cu	Copper or copper alloys
Al	Aluminium or aluminium alloys
Mg	Magnesium or magnesium alloys
PL	Plastic materials, plateable grades

A.2 Coatings

Table A.2 — Symbols for coatings

Coating symbol	Description	Coating symbol	Description
Ag	Silver and silver alloys	Pb	Lead
Au	Gold	Pd	Palladium
AuAg	Gold-silver alloys	PdNi	Palladium-nickel alloys
AuNi	Gold-nickel alloys	Sn	Tin
Cu	Copper	SnNi	Tin-nickel alloys
Cd	Cadmium	SnPb	Tin-lead alloys
Cr	Chromium	Zn	Zinc
Ni	Nickel	ZnNi	Zinc-nickel alloys
NiCo	Nickel-cobalt alloys	ZnCo	Zinc-cobalt alloys
NiP	Nickel-phosphorus alloys	ZnFe	Zinc-iron alloys

A.3 Undercoats

Table A.3 — Commonly used undercoats

Coating symbol	Description
Cu	Copper
Ni	Nickel
Cu plus Ni	Copper plus nickel
Pd	Palladium in engineering applications
PdNi	Palladium-nickel alloys; e.g. with engineering gold coatings
PdCo	Palladium-cobalt alloys; e.g. with engineering gold coatings

A.4 Symbols for different types of coating

Table A.4 — Symbols for coating type

Symbol for coating type [a]	Description (International Standard) [b]
a	ductile, levelling electroplated copper (ISO 1456 and ISO 4525)
b	electroplated bright nickel (ISO 1456 and ISO 4525)
p	dull or semi-bright electroplated nickel, mechanically polished (ISO 1456)
s	dull, semi-bright or satin nickel, *not* mechanically polished (ISO 1456 and ISO 4525)
d	double- or triple-layer nickel coatings (ISO 1456 and ISO 4525)
r	regular chromium (ISO 1456 and ISO 4525)
mc	micro-cracked chromium (ISO 1456 and ISO 4525)
mp	micro-porous chromium (ISO 1456 and ISO 4525)
hr	regular hard chromium (ISO 6158)
hm	hard chromium from mixed acid solutions (ISO 6158)
hc	micro-cracked hard chromium (ISO 6158)
hp	micro-porous hard chromium (ISO 6158)
hd	duplex chromium (ISO 6158)
hs	special types of chromium (ISO 6158)
sf	sulfur-free (ISO 4526)
sc	sulfur-containing (ISO 4526)
pd	sulfur-free nickel with dispersed particles in the nickel matrix (ISO 4526)

[a] The symbols in this column are lower-case letters.

[b] See Bibliography for the titles of the International Standards cited.

A.5 Codes for chromate conversion coatings

Table A.5 — Chromate conversion coating codes (ISO 2081)

Type	
Code	**Description**
A	Clear
B	Bleached
C	Iridescent
D	Opaque
F	Black

A.6 Codes for supplementary treatments

Table A.6 — Codes for supplementary treatments (ISO 2081)

Code	Type of treatment
T1	Application of paints, varnishes, powder coatings or similar coating materials
T2	Application of organic or inorganic sealants
T3	Application of organic dye
T4	Application of grease or oil, or other lubricants
T5	Application of wax

Annex B
(informative)

Examples of designations

B.1 Decorative nickel plus chromium (ISO 1456[1])

A coating on steel comprising 20 µm (minimum) ductile, levelling copper plus 30 µm (minimum) bright nickel plus 0,3 µm micro-cracked chromium is designated as follows:

Electrodeposited coating ISO 1456 – Fe/Cu20a/Ni30b/Cr mc

B.2 Electrodeposited zinc with supplementary treatments on iron or steel (ISO 2081[4])

An electrodeposited coating of 25 µm zinc (Zn 25) on iron or steel (Fe) which is to be heat treated after electroplating for hydrogen embrittlement relief heat treatment (ISO 9588[14]) for 8 h at 190 °C [ER(190)8] and has been given a supplementary opaque chromate conversion coating, D, followed by a sealing treatment consisting of the application of an organic sealant (T2) is designated as follows:

Electrodeposited coating ISO 2081 – Fe/Zn25/ER (190)8/D/T2

B.3 Electrodeposited gold (ISO 27874[16])

A pure gold coating with a minimum thickness of 5 µm (Au5) deposited over a copper undercoat that is 5 µm thick (Cu5) on a steel that has an ultimate tensile strength of 1 200 MPa heat treated prior to electroplating for stress relief at 200 °C for 3 h [SR(200)3,] and after electroplating to reduce the risk of hydrogen embrittlement at 190 °C for at least 12 h, ER(190)12 is designated as follows:

Electrodeposited coating ISO 27874 – Fe/SR(200)3/Cu5/Au5/ER(190)12

B.4 Decorative copper plus nickel plus chromium on plastics (ISO 4525[9])

A bright nickel coating with a minimum thickness of 10 µm (Ni10b) on a plastic material, deposited over an electrodeposited ductile copper layer 15 µm thick (Cu15a) and subsequently electroplated with 0,3 µm (minimum) microporous chromium [Cr mp (or mc)] is designated as follows:

Electrodeposited coating ISO 4525 – PL/Cu15a/Ni10b/Cr mp (or mc)

B.5 Engineering nickel and nickel alloy coatings (ISO 4526[10])

An engineering nickel coating that is sulfur-free and has a minimum local thickness of 25 µm, deposited on high strength steel that is stress relieved prior to electroplating at 210 °C for 2 h and is also heat treated for embrittlement relief purposes at 210 °C for 22 h is designated as follows:

Electrodeposited coating ISO 4526 – Fe/SR(210)2/Ni25sf/ER(210)22