
**Metallic and other inorganic
coatings — Requirements for the
designation of metallic and inorganic
coatings**

*Revêtements métalliques et autres revêtements inorganiques —
Exigences pour la désignation des revêtements métalliques et autres
revêtements inorganiques*





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Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Information to be supplied to the electroplater (or processor) by the purchaser	1
4.1 Essential information	1
4.2 Additional information	2
5 Designation	2
5.1 General	2
5.1.1 Designation specification	2
5.1.2 Description and International Standard number modules	3
5.1.3 Individual item module	3
5.2 Designation of the basis material	3
5.3 Designation of heat treatment requirements	4
5.4 Designation of the type and thickness of the coatings	4
6 Sampling	4
Annex A (normative) Symbols for designating metallic and other inorganic coatings	5
Annex B (informative) Examples of designations	8
Annex C (informative) Service condition numbers and severity	10
Bibliography	11

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).

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).

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For an explanation on the voluntary nature of standards, 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.

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 262, *Metallic and other inorganic coatings*, in collaboration with ISO Technical Committee TC 107, *Metallic and other inorganic coatings*, Subcommittee SC 3, *Electrodeposited coatings and related finishes*, in accordance with the agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 27830:2008), which has been technically revised.

Metallic and other inorganic coatings — Requirements for the designation of metallic and inorganic coatings

WARNING — This document can be non-compliant with some countries' health, safety and environmental legislations and calls for the use of substances and/or procedures that can be injurious to health, if adequate safety measures are not taken. This document 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 document to establish appropriate health, safety and environmentally acceptable practices and take appropriate action to comply with any national, regional and/or International regulations.

1 Scope

This document 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 document, but can be found in the International Standards listed in the Bibliography.

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

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.

ISO 9587, *Metallic and other inorganic coatings — Pretreatment of iron or steel to reduce the risk of hydrogen embrittlement*

ISO 9588, *Metallic and other inorganic coatings — Post-coating treatments of iron or steel to reduce the risk of hydrogen embrittlement*

3 Terms and definitions

No terms and definitions are listed in this document.

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>

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 this document (see [Clause 5](#));
- b) the significant surface indicated by drawings or by suitably marked specimens;
- c) the nature, condition and finish of the basis material, if they affect serviceability and/or the appearance of the coating;
- d) the tensile strength of the component to enable possible de-embrittlement requirements to be taken into account;
- e) the requirements for heat treatment before and/or after coating, if the requirements are not in accordance with ISO 9587 or ISO 9588.

4.2 Additional information

Additional information, not included in [4.1](#), that may be required for a specific coating, product or application, may include, for example,

- a) the appearance required, for example, bright, dull, colour, preferably with samples of the required finish (if not specified in an applicable ISO Standard);
- b) the accepted position(s) on the surface for unavoidable defects, such as jigs, contact marks or areas in which it is permitted for the coating to be absent;
- c) the standards for determining that thickness, corrosion resistance, adhesion, porosity or other requirements have been met;
- d) sampling methods, acceptance levels and inspection requirements for quality control purposes;
- e) extra information, for example, packaging or handling instructions or a delivery address shall be included where relevant.

5 Designation

5.1 General

5.1.1 Designation specification

Symbols for designating metallic and other inorganic coatings shall be applied, as specified in [Annex A](#).

The designation shall comprise the following:

- a) description and International Standard number modules in accordance with [5.1.2](#);
- b) a hyphen;
- c) the individual item module in accordance with [5.1.3](#);
- d) a solidus;
- e) the additional applicable codes separated by solidi for every stage of the coating sequence in the order of application (see [5.3](#)).

Double separators shall be used to indicate any missing stages (i.e. when a particular stage is not required).

NOTE Allowed composition and purity tolerances for the values shown in the designation are specified in the International Standards for the coatings to which they are applicable.

The purchaser should be guided in their choice of designation by the severity of service conditions to be withstood by the coating.

See [Annex B](#) for examples.

5.1.2 Description and International Standard number modules

The description module briefly describes the designated coating:

- 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, if applicable (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, if applicable (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 E527[18].

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), the letters HR for hydrogen embrittlement relief heat treatment (ISO 9588), 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) Supplementary treatments (e.g. those commonly used with zinc and cadmium coatings) shall be designated by the symbols in [Table A.4](#).
- f) 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].

NOTE 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](#).

6 Sampling

Reference should be made to ISO 4519[7] for sampling plans for inspection. ISO 2859 (all parts)[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.

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 giving requirements relating to the coating type) ^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 lowercase 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
F	Black

A.6 Codes for supplementary treatments

Table A.6 — Codes for supplementary treatments (ISO 19598, adapted)

Code	Type of treatment
Tx	Sealant may or may not be present
T0	No sealant
T2nL	Sealant with no integral lubricant
T2yL	Sealant with integral lubricant
T3	Inclusion of an organic dye
T7nL	Top coat without integral lubricant
T7yL	Top coat with integral lubricant

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 12 µm zinc (Zn 12) on iron or steel (Fe), which is to be heat-treated after electroplating for hydrogen embrittlement relief heat treatment (ISO 9588) for 8 h at 190 °C [ER(190)8] and has been given a supplementary clear chromate conversion coating, A, followed by a sealing treatment consisting of the application of a sealant with integral lubricant (T2yL), is designated as follows:

Electrodeposited coating ISO 2081 - Fe/Zn12/ER (190)8/A/T2yL

B.3 Electrodeposited gold (ISO 27874[17])

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 and 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

B.6 Autocatalytic nickel-phosphorus alloy coatings (ISO 4527[11])

An autocatalytic nickel-phosphorus coating, having a nominal phosphorus content of 10 % mass fraction and a thickness of 15 µm applied to G43400 steel, requiring stress relieving prior to coating at 210 °C for 22 h, subsequently electroplated with chromium, 0,5 µm thick, and requiring heat treatment for hydrogen embrittlement relief at 210 °C for 22 h is designated as follows:

Autocatalytic coating ISO 4527 - Fe(G43400)/SR(210)22/NiP(10)15/Cr0,5/ER(210)22

B.7 Vapour-deposited cadmium coating (ISO 22778[16])

A vapour-deposited cadmium coating, 5 µm thick on high-strength steel, requiring stress relieving prior to coating at 150 °C for 2 h and with a supplementary black chromate conversion coating, is designated as follows:

Vapour-deposited coating ISO 22778 - Fe/SR(150)2/Cd5/F

Annex C (informative)

Service condition numbers and severity

The service condition number designates the severity of the conditions to which the coating will be subjected in service. Numbers from 1 to 5 indicate increasingly severe service conditions, 1 being the least severe. Service conditions are taken into consideration when selecting the coating designation. The relation between service condition number and the designation, including thickness recommendations, may be found in many of the International Standards covering specific coatings. Examples of service condition numbers and a description of the severity of the corresponding service conditions are given in [Table C.1](#).

Table C.1 — Examples of service conditions

Service condition number	Description of the severity of service conditions
1	<i>Mild</i> — Exposure indoors in normally warm, dry atmospheres with minimum wear and abrasion
2	<i>Moderate</i> — Exposure indoors in places where condensation of moisture may occur, as in kitchens and bathrooms
3	<i>Severe</i> — Service outdoors where occasional or frequent exposure to rain, dew, strong cleaners and saline solutions may occur
4	<i>Very severe</i> — Service outdoors that is likely to include denting, scratching and abrasive wear, in addition to exposure to corrosive environments, e.g. as in marine and industrial applications
5	<i>Extended very severe</i> — Service outdoors that is likely to include denting, scratching and abrasive wear, in addition to exposure to corrosive environments where long-time protection of the substrate is required, e.g. conditions encountered by some exterior components of automobiles

NOTE Information on corrosivity of environments can be found in ISO 11844^[14] (for internal environments) and ISO 9223^[13] (for external environments).

Bibliography

- [1] ISO 1456, *Metallic and other inorganic coatings — Electrodeposited coatings of nickel, nickel plus chromium, copper plus nickel and of copper plus nickel plus chromium*
- [2] ISO 2064, *Metallic and other inorganic coatings — Definitions and conventions concerning the measurement of thickness*
- [3] ISO 2080, *Metallic and other inorganic coatings — Surface treatment, metallic and other inorganic coatings — Vocabulary*
- [4] ISO 2081, *Metallic and other inorganic coatings — Electroplated coatings of zinc with supplementary treatments on iron or steel*
- [5] ISO 2082, *Metallic and other inorganic coatings — Electroplated coatings of cadmium with supplementary treatments on iron or steel*
- [6] ISO 2859 (all parts), *Sampling procedures for inspection by attributes*
- [7] ISO 4519, *Electrodeposited metallic coatings and related finishes — Sampling procedures for inspection by attributes*
- [8] ISO 4521, *Metallic and other inorganic coatings — Electrodeposited silver and silver alloy coatings for engineering purposes — Specification and test methods*
- [9] ISO 4525, *Metallic coatings — Electroplated coatings of nickel plus chromium on plastics materials*
- [10] ISO 4526, *Metallic coatings — Electroplated coatings of nickel for engineering purposes*
- [11] ISO 4527, *Metallic coatings — Autocatalytic (electroless) nickel-phosphorus alloy coatings — Specification and test methods*
- [12] ISO 6158, *Metallic and other inorganic coatings — Electrodeposited coatings of chromium for engineering purposes*
- [13] ISO 9223, *Corrosion of metals and alloys — Corrosivity of atmospheres — Classification, determination and estimation*
- [14] ISO 11844 (all parts), *Corrosion of metals and alloys — Classification of low corrosivity of indoor atmospheres*
- [15] ISO 19598, *Metallic coatings — Electroplated coatings of zinc and zinc alloys on iron or steel with supplementary Cr(VI)-free treatment*
- [16] ISO 22778, *Metallic coatings — Physical vapour-deposited coatings of cadmium on iron and steel — Specification and test methods*
- [17] ISO 27874, *Metallic and other inorganic coatings — Electrodeposited gold and gold alloy coatings for electrical, electronic and engineering purposes — Specification and test methods*
- [18] ASTM E527, *Standard Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)*

