

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS H 8630 : 2006
(SFJ/JSA)

**Electroplated coatings on plastics
materials for decorative purposes**

ICS 25.220.60

Reference number : JIS H 8630 : 2006 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by The Surface Finishing Society of Japan (SFJ)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS H 8630 : 1987** is replaced with this Standard.

This revision has been made based on **ISO 4525 : 2003** *Metallic coatings—Electroplated coatings of nickel plus chromium on plastics materials* for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

Date of Establishment: 1987-10-01

Date of Revision: 2006-03-25

Date of Public Notice in Official Gazette: 2006-03-27

Investigated by: Japanese Industrial Standards Committee

Standards Board

Technical Committee on Non-Ferrous Metals

JIS H 8630 : 2006, First English edition published in 2006-10

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

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Printed in Japan

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Contents

	Page
Introduction.....	1
1 Scope	1
2 Normative references	1
3 Definitions	2
4 Kind, type of coatings and their symbols	2
5 Grades, constitution and minimum thickness	3
6 Quality	4
7 Basis materials	6
8 Tests	6
9 Inspection	8
10 Designation of coating	8
11 Marking	9
12 Entries in purchase order or process specification	9
Annex A (normative) Thermal cycle test method	11
Annex B (informative) Service condition numbers and service conditions	13
Annex C (normative) Coating ductility test method	14
Annex D (informative) Test method for determination of sulfur content of nickel coating	15
Annex E (normative) Test method for micropores and microcracks of chromium coatings	16
Annex F (normative) Method for combined thermal cycle and corrosion resistance test	18
Annex 1 (normative) Adhesion test method	19
Annex 2 (normative) Corrosion resistance test methods for gold and gold alloy coatings	21
Annex 3 (informative) Comparison table between JIS and corresponding International Standard	23

Electroplated coatings on plastics materials for decorative purposes

Introduction This Japanese Industrial Standard has been prepared based on the second edition of **ISO 4525** *Metallic coatings—Electroplated coatings of nickel plus chromium on plastics materials* published in 2003 with some modifications of the technical contents of the original International Standard.

The portions given sidelines or dotted underlines are the matters in which the contents of the original International Standard have been modified. A list of modifications with the explanations is given in Annex 3 (informative).

1 Scope This Standard specifies the effective surfaces of electroplated coatings⁽²⁾ (hereafter referred to as “coatings”) on plastics materials for decorative purposes⁽¹⁾.

Notes ⁽¹⁾ The decorative purposes refer to purposes for using the coatings which place importance on appearance, corrosion resistance, etc. mainly for automobiles, household appliances, daily goods, etc.

⁽²⁾ Electroplated coatings refer to nickel coatings on plastics materials (including undercoats of copper or ductile nickel in order to improve the adhesion between plastics materials and nickel coatings) and coatings of chromium, gold and gold alloy, silver and silver alloy, tin-cobalt alloy, tin-nickel alloy, tin-copper-zinc alloy, tin-nickel-copper alloy on nickel coatings.

Information : Ductile nickel refers to a nickel coating which is excellent in ductile properties. It is obtained by carrying out electrodeposition from the Watts bath which does not contain an organic additive or a brightener, a sulfamate bath or an exclusive bath on the market.

NOTE : The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 4525:2003 *Metallic coatings—Electroplated coatings of nickel plus chromium on plastics materials* (MOD)

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS H 0400 *Glossary of terms used in electroplating and related processes*

NOTE : **ISO 2080**:1981 *Electroplating and related processes—Vocabulary* is equivalent to the said standard.

JIS H 0404 *Graphical symbol for electroplated coating*

JIS H 8501 *Methods of thickness test for metallic coatings*

NOTE : Following **ISO** Standards are equivalent to the said standard.

ISO 1463:1982 *Metallic and oxide coatings—Measurement of coating thickness—Microscopical method*

ISO 2064:1996 *Metallic and other inorganic coatings—Definitions and conventions concerning the measurement of thickness*

ISO 2177:1985 *Metallic coatings—Measurement of coating thickness—Coulometric method by anodic dissolution*

ISO 2361:1982 *Electrodeposited nickel coatings on magnetic and non-magnetic substrates—Measurement of coating thickness—Magnetic method*

ISO 3497:1990 *Metallic coatings—Measurement of coating thickness—X-ray spectrometric methods*

ISO 3543:1981 *Metallic and non-metallic coatings—Measurement of thickness—Beta backscatter method*

JIS H 8502 *Methods of corrosion resistance test for metallic coatings*

NOTE : **ISO 9227**:1990 *Corrosion tests in artificial atmospheres—Salt spray tests* is equivalent to the said standard.

3 Definitions For the purposes of this Standard, the definitions given in **JIS H 0400** apply.

4 Kind, type of coatings and their symbols The kind, type of coatings and their symbols shall be as given in table 1.

Table 1 Kind, type of coatings and their symbols

Kind of coating	Symbol of kind of coating	Type of coating	Symbol of type of coating
Copper coating ⁽³⁾	Cu	—	—
Nickel coating	Ni	Bright nickel	b
		Semi-bright nickel	s
		Velvet state nickel	y
		No leveling nickel	n
		Double-layer nickel coating	d
		Triple-layer nickel coating	t
		Ductile nickel ⁽⁴⁾	dp
Chromium coating	Cr	Ordinary chromium	r
		Micro-porous chromium	mp
		Micro-cracked chromium	mc
Gold coating	Au	—	—
Silver coating	Ag	—	—

Table 1 (concluded)

Kind of coating		Symbol of kind of coating	Type of coating	Symbol of type of coating
Alloy coating	Tin-cobalt	Sn-Co	—	—
	Tin-nickel	Sn-Ni		
	Tin-copper-zinc	Sn-Cu-Zn		
	Tin-nickel-copper	Sn-Ni-Cu		

Notes ⁽³⁾ Copper coating used for an undercoat is a coating with ductility and smoothness electrodeposited from the acidic coating bath.

⁽⁴⁾ Ductile nickel coating used for an undercoat is a coating which can endure the thermal cycle test.

5 Grades, constitution and minimum thickness The grade of coatings shall be categorized by the kind and type of nickel coating and uppermost layer coating and the minimum thickness of coating, and shall be as given in table 2 and table 3.

In addition, the kind and minimum thickness of coating in the case where copper or ductile nickel is plated as an undercoat, and the constitution and minimum thickness in the case where gold, silver, and alloy coating are used as an uppermost coating shall be in accordance with the agreement between the purchaser and the manufacturer.

Table 2 Grades, constitution and minimum thickness of coating (uppermost layer: chromium coating)Unit: μm

Grade	Constitution and minimum thickness of coating				Information
	Nickel coating		Uppermost layer coating		Service condition number
	Symbol of kind and type of coating	Minimum thickness	Symbol of kind and type of coating	Minimum thickness	
Grade 1	Ni b, Ni s Ni v, Ni n	5	Cr r	0.1	1
		7		0.3	
Grade 2	Ni b, Ni s Ni v, Ni n Ni d, Ni t	10	Cr r	0.1	2
		15		0.3	
Grade 3	Ni d, Ni t	20	Cr r	0.1	3
		25		0.3	
	Ni b, Ni s Ni d, Ni t	15	Cr mp, Cr mc	0.1	
		20		0.3	
Grade 4	Ni d, Ni t	20	Cr mp, Cr mc	0.1	4
		25		0.3	
Grade 5	Ni d, Ni t	30	Cr mp, Cr mc	0.1	5
		30		0.3	

Information : The service condition corresponding to the service condition number of coating is given in Annex B.

Table 3 Grades, constitution and minimum thickness of coating
[uppermost layer: gold, silver⁽⁵⁾, tin-cobalt alloy, tin-nickel alloy,
tin-copper-zinc alloy, tin-nickel-copper alloy]

Unit: μm

Grade	Constitution and minimum thickness of coating				Information
	Nickel coating		Uppermost layer coating		Service condition number
	Symbol of kind and type of coating	Minimum thickness	Symbol of kind and type of coating	Minimum thickness	
Grade 1	Ni b, Ni s Ni v, Ni n	5	Au, Ag	—	1
			Sn-Co, Sn-Ni, Sn-Cu-Zn, Sn-Ni-Cu		
Grade 2	Ni b, Ni s Ni v, Ni n Ni d, Ni t	10	Au, Ag	—	2
			Sn-Co, Sn-Ni, Sn-Cu-Zn, Sn-Ni-Cu		
Grade 3	Ni d, Ni t	20	Sn-Co, Sn-Ni	—	3

Note ⁽⁵⁾ Includes gold alloy and silver alloy coating.

6 Quality Quality shall be as follows⁽⁶⁾:

Note ⁽⁶⁾ Selection of quality by performing the test is applied to only the use in which a special importance is placed on the quality in accordance with the agreement between the purchaser and the manufacturer.

- a) **Appearance of coating** The appearance of coating, when subjected to the test of **8 b)**, shall be free from rough surface, burnt deposits, cracks, pits, defects such as exposure of basis material, blisters, sign of poor adhesion such as peeling, stains, and flaws⁽⁷⁾ on the effective surface of coating.

Note ⁽⁷⁾ In the case where although the basis material has defects and the defects cannot be detected by the normal method, the defects appear like defects of coating by electroplating, the quality judgement shall be performed in accordance with the agreement between the purchaser and the manufacturer.

- NOTES 1 The designation of the degree of appearance shall be as agreed between the purchaser and the manufacturer.
- 2 When the contact point on the effective surface of coating cannot be avoided, the designation of the location shall be as agreed between the purchaser and the manufacturer.
- 3 The appearance except on the effective surface shall be as agreed between the purchaser and the manufacturer.

- b) **Minimum thickness of coating** The minimum thickness of coating for the effective surface which the sphere of 20 mm in diameter can contact, when subjected to the test of **8 c)**, shall comply with table 2 and table 3.

Information : The sulfur content and thickness of double-layer nickel coating and triple-layer nickel coating shall be as given in Information table 1.

Information Table 1 Sulfur content and thickness of double-layer nickel coating and triple-layer nickel coating

Layer	Sulfur content ⁽⁸⁾ % (mass fraction)	Thickness ⁽⁹⁾ Percentage to total nickel thickness %	
Bottom (s: semi-bright nickel)	Under 0.005	50 or over	50 or over up to and incl. 70
Middle (high sulfur layer)	Over 0.15	—	10 or under
Top (b: bright nickel)	Over 0.04 to and excl. 0.15	10 or over up to and incl. 50	30 or over

Notes ⁽⁸⁾ The test of sulfur content of nickel coating on the plated product shall be as given in **8 c)** of Information 1.

⁽⁹⁾ The thickness of each coating layer can be measured by the microscopic section test method in **8 c)** or the coulometric test method in Information 2 of **8 c)**.

- c) **Number of micropores and microcracks of chromium coating** For micro-porous chromium coating and micro-cracked chromium coating, when tested according to **8 d)**, micropores and microcracks shall be distributed densely and uniformly over the whole effective surface of coating, and the number of micropores and microcracks shall be as specified in table 4.

Table 4 Number of micropores and microcracks

Type I uppermost chromium coating 0.1 µm or over	Number of micropores of micro-porous chromium	10 000 pieces/cm ² min.
	Number of microcracks of micro-cracked chromium	100 streaks/cm min.
Type II uppermost chromium coating 0.3 µm or over	Number of micropores of micro-porous chromium	10 000 pieces/cm ² min.
	Number of microcracks of micro-cracked chromium	250 streaks/cm min. ⁽¹⁰⁾

Note ⁽¹⁰⁾ For some chromium coating bath, it is necessary to carry out the thicker chromium coating (about 0.8 µm) in order to create this crack pattern.

- d) **Corrosion resistance of coating** For the corrosion resistance of coating, when tested according to **8 e)**, the rating number specified in **JIS H 8502** shall be not less than 8. However, the corrosion rate in the case of corrodokote test shall be as given in table 5. Furthermore, when gold or gold alloy coating is applied as the uppermost layer, the reference of corrosion resistance in nitric-acid-aeration and high temperature-high humidity test methods shall be as agreed between the purchaser and the manufacturer.

Table 5 Corrosion rate in corrodokote test

Grade	Overall corrosion rate %	Local corrosion rate %
Grade 1	—	—
Grade 2	20 max.	30 max.
Grade 3	10 max.	15 max.
Grade 4	5 max.	10 max.

- e) **Adhesion of coating** The adhesion of coating, when tested according to **8 f)**, shall be free from defects such as blisters, peeling, cracks for the test in Annex A. Or for the test in Annex 1, the adhesion of coating shall be not less than 5 N/cm.

NOTE : For the corrosion resistance of coating and adhesion of coating, the combined thermal cycle and corrosion resistance test may be performed for the plated product of which the service condition number given in table 2 is 5, 4 and 3. The combination test shall be performed as specified in **8 g)**, and the rating number specified in **JIS H 8502** shall be not less than 8, and the coating shall be free from defects such as blisters, peeling.

- f) **Ductility of coating** For the ductility of coating, the elongation of the following coating, when tested according to **8 h)**, shall be not less than 8 %.

- 1) Copper undercoat
- 2) Ductile nickel coating
- 3) Bottom layer nickel coating of double-layer nickel coating and triple-layer nickel coating

7 Basis materials The condition of basis materials before coating has a significant effect on quality of coating. Especially, when the basis materials are supplied from the purchaser, the purchaser shall give information on basis materials to the process specification, etc.

8 Tests The tests shall be as follows.

NOTE : The selection of the test method for the test in which multiple test methods are described shall be as agreed between the purchaser and the manufacturer.

- a) **Preparation of test specimen** The test specimen shall be normally prepared from the plated product. However, when the plated product itself cannot be used as the test specimen, the test shall be performed using the alternative test specimen.

The alternative test specimen shall be prepared using the same basis material and the same coating condition as those of the plated product if at all possible.

- b) **Visual test** The visual test shall be performed by visual inspection, and presence or absence of rough surface, burnt deposits, cracks, pits, defects such as exposure of basis material, sign of poor adhesion, stains, flaws, etc. shall be examined.

- c) **Coating thickness test** The coating thickness test shall be performed in accordance with any of the microscopic section test method, coulometric test method, fluorescent X-ray spectrometric test method, beta back-scatter test method and magnetic test method specified in **JIS H 8501**.

Information 1 There is no simple method for measuring the sulfur content in nickel coating. Therefore, it shall be measured in accordance with the method described in Annex D by showing the kind and composition of nickel coating bath or using the test specimen specially prepared.

- 2 There is a coulometric test method by which not only the mutual electrochemical relation (potential difference) of each nickel layer of double-layer nickel coating or triple-layer nickel coating but also the thickness of an individual layer can be measured.

- d) **Micropore and microcrack test for chromium coating** The micropore and microcrack test for chromium coating shall be performed in accordance with Annex E.

- e) **Corrosion resistance test** The corrosion resistance test shall be performed according to the CASS test method, neutral salt spray test method, neutral salt spray cycle test method or corrodkote test method specified in **JIS H 8502**, and the period of time of the test shall be as given in table 6.

In addition, for the product which uses gold coating and gold alloy coating as the uppermost layer, the corrosion resistance test shall be performed according to Annex 2.

Table 6 Period of time of corrosion resistance test

Unit: h

Grade	CASS test	Neutral salt spray test	Neutral salt spray cycle test ⁽¹⁾	Corrodkote test
Grade 1	—	8	16 (2)	—
Grade 2	8	16	24 (3)	16
Grade 3	16	—	48 (6)	16
Grade 4	32	—	96 (12)	16
Grade 5	48	—	144 (18)	—

Note ⁽¹⁾ As specified in **JIS H 8502**, one cycle is 8 h, and the figure in the parentheses indicates the number of cycles.

NOTES 1 For some kind of the uppermost layer coating, there may be a case where deterioration in brightness occurs in the coating during the test which is performed according to the test method used.

- 2 In the case where the uppermost layer coating specified in table 3 is tin alloy coating, the CASS test and corrodkote test do not apply.

- f) **Adhesion test** The adhesion test shall be performed in accordance with Annex A or Annex 1.

- g) **Combined thermal cycle and corrosion resistance test** The combined thermal cycle and corrosion resistance test shall be performed in accordance with Annex F.
- h) **Ductility test** The ductility test shall be performed in accordance with Annex C.

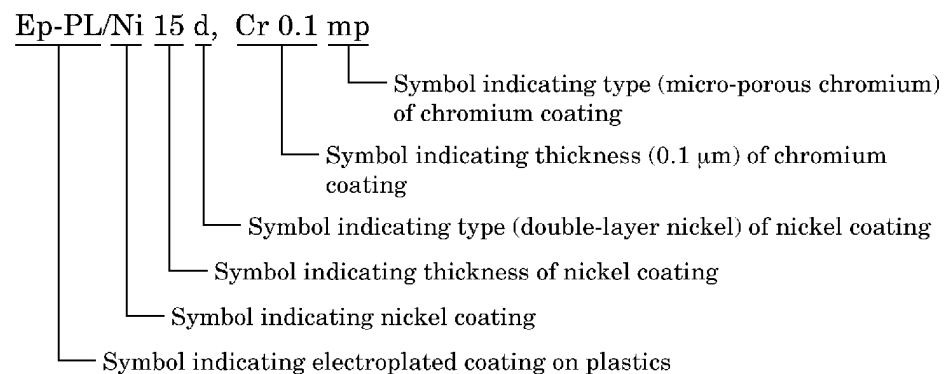
9 Inspection The inspection shall be performed as follows:

- a) The coating, when tested in accordance with clause 8, shall conform to the requirements specified in clause 6.
- b) The sample shall be taken from the lot of the same product in accordance with the agreement⁽¹²⁾ between the purchaser and the manufacturer.
- c) The number of test specimens, the inspection order and the location to be inspected, and the alternative use of test specimens shall be subjected to the agreement between the purchaser and the manufacturer.
- d) The judgement criteria of the lot shall be as agreed between the purchaser and the manufacturer.

Note ⁽¹²⁾ When an agreement between the purchaser and the manufacturer is made, JIS Z 9002, JIS Z 9003, JIS Z 9004, JIS Z 9015-0, JIS Z 9015-2, JIS Z 9031 and ISO 4519 should be referred to.

10 Designation of coating The designation of coating shall be expressed in accordance with **JIS H 0404**.

Example 1 Double-layer nickel 15 μm , micro-porous chromium 0.1 μm coatings on plastics



Example 2 Nickel, Grade 3 chromium coatings on plastics

