



Electroplated coatings of nickel and chromium

1. Scope

This Japanese Industrial Standard specifies the significant surfaces ⁽¹⁾ of coatings, conducted for the purpose of corrosion prevention and ornamentation, of nickel, copper-nickel, nickel-chromium and copper-nickel-chromium (hereafter referred to as the "coatings") ⁽²⁾ ⁽³⁾ on the base material of steel, copper, copper alloy, zinc alloy, aluminium and aluminium alloy.

Notes ⁽¹⁾ The significant surface means a surface important for service.

⁽²⁾ Two-layer nickel, microcrack chromium, and microporous chromium are included.

⁽³⁾ Brass coating is included in copper coating.

Remarks 1. Applicable standards in this Standard are shown as follows:

JIS H 0400-Glossary of Terms Used in Electroplating

JIS H 0404-Graphical Symbol for Electroplated Coating

JIS H 8501-Methods of Thickness Test for Metallic Coatings

JIS H 8502-Methods of Corrosion Resistance Test for Metallic Coatings

JIS H 8504-Methods of Adhesion Test for Metallic Coatings

JIS K 8150-Sodium Chloride

JIS K 8801-Potassium Hexacyanoferrate (III)

JIS K 8802-Potassium Hexacyanoferrate (II) Trihydrate

JIS K 8951-Sulfuric Acid

JIS K 8983-Copper (II) Sulfate Pentahydrate

JIS P 3801-Filter Paper (for Chemical Analysis)

JIS Z 8902-Xenon Standard White Light Source

JIS Z 9031-Random Sampling Methods

2. Corresponding International Standard in this Standard is given as follows:

ISO 1456 - Metallic coatings - Electrodeposited coatings of nickel plus chromium and of copper plus nickel plus chromium

2. Definitions

Definitions of main terms used in this Standard shall be in accordance with JIS H 0400.

3. Classes, grades and symbols

The class and grade of coatings shall be classified as given in Tables 1 to 2 according to base metal, substrate coating, finish coating, and the minimum thickness of coating, and their symbols shall be as given in JIS H 0404.

Table 1. Classes, grades and symbols

Base metal	Class of coating metal	Grade	Coating minimum thickness μm	Symbol
Steel	Copper-nickel coating	Grade 1	3	Ep-Fe/Cu+Nib 3 or Ep-Fe/Cu+Nib [1]
		Grade 2	5	Ep-Fe/Cu+Nib 5 or Ep-Fe/Cu+Nib [2]
		Grade 3	10	Ep-Fe/Cu+Nib 10 or Ep-Fe/Cu+Nib [3]
		Grade 4	15	Ep-Fe/Cu+Nib 15 or Ep-Fe/Cu+Nib [4]
		Grade 5	20	Ep-Fe/Cu+Nib 20 or Ep-Fe/Cu+Nib [5]
Copper and copper alloy	Nickel coating	Grade 1	3	Ep-Cu/Ni 3 b or Ep-Cu/Nib [1]
		Grade 2	5	Ep-Cu/Ni 5 b or Ep-Cu/Nib [2]
		Grade 3	10	Ep-Cu/Ni 10 b or Ep-Cu/Nib [3]

Remarks: Each coating thickness of copper-nickel coating shall be as agreed upon between the parties concerned with delivery.

Table 2 A. Classes, grades and symbols

Base metal	Class of coating metal	Grade	Substrate coating	Minimum thickness of substrate coating μm	Finish coating	Minimum thickness of finish coating μm	Symbol
Steel	Nickel-chromium coating	Grade 1	Nib	3	Cr r	0.1	Ep-Fe/Ni 3 b, Cr 0.1 r or Ep-Fe/Nib, Cr r [1]
		Grade 2	Nib	5	Cr r	0.1	Ep-Fe/Ni 5 b, Cr 0.1 r or Ep-Fe/Nib, Cr r [2]
		Grade 3	Nib	10	Cr r	0.1	Ep-Fe/Ni 10 b, Cr 0.1 r or Ep-Fe/Nib, Cr r [3]
		Grade 4	Nib	15	Cr r	0.1	Ep-Fe/Ni 15 b, Cr 0.1 r or Ep-Fe/Nib, Cr r [4]
		Grade 5	Nib	20	Cr r	0.1	Ep-Fe/Ni 20 b, Cr 0.1 r or Ep-Fe/Nib, Cr r [5]
		Grade 6	Nid	25	Cr mp	0.1	Ep-Fe/Ni 25 d, Cr 0.1 mp or Ep-Fe/Nid, Cr mp [6]
			Nid	25	Cr mc	0.1	Ep-Fe/Ni 25 d, Cr 0.1 mc or Ep-Fe/Nid, Cr mc [6]
		Grade 7	Nid	30	Cr r	0.1	Ep-Fe/Ni 30 d, Cr 0.1 r or Ep-Fe/Nid, Cr r [7]
		Grade 8	Nib	40	Cr r	0.1	Ep-Fe/Ni 40 b, Cr 0.1 r or Ep-Fe/Nib, Cr r [8]
		Grade 9	Nid	30	Cr mp	0.1	Ep-Fe/Ni 30 d, Cr 0.1 mp or Ep-Fe/Nid, Cr mp [9]
			Nid	30	Cr mc	0.1	Ep-Fe/Ni 30 d, Cr 0.1 mc or Ep-Fe/Nid, Cr mc [9]

Table 2 B. Classes, grades and symbols

Base metal	Class of coating metal	Grade	Substrate coating	Minimum thickness of substrate coating μm	Finish coating	Minimum thickness of finish coating μm	Symbol
Steel	Copper-nickel-chromium coating	Grade 1	Cu, Nib	3	Cr r	0.1	Ep-Fe/Cu+Nib 3, Cr 0.1 r or Ep-Fe/Cu+Nib, Cr r [1]
		Grade 2	Cu, Nib	5	Cr r	0.1	Ep-Fe/Cu+Nib 5, Cr 0.1 r or Ep-Fe/Cu+Nib, Cr r [2]
		Grade 3	Cu, Nib	10	Cr r	0.1	Ep-Fe/Cu+Nib 10, Cr 0.1 r or Ep-Fe/Cu+Nib, Cr r [3]
		Grade 4	Cu, Nib	15	Cr r	0.1	Ep-Fe/Cu+Nib 15, Cr 0.1 r or Ep-Fe/Cu+Nib, Cr r [4]
		Grade 5	Cu, Nib	25	Cr r	0.1	Ep-Fe/Cu+Nib 25, Cr 0.1 r or Ep-Fe/Cu+Nib, Cr r [5]
		Grade 6	Cu, Nib	30	Cr r	0.1	Ep-Fe/Cu+Nib 30, Cr 0.1 r or Ep-Fe/Cu+Nib, Cr r [6]
		Grade 7	Cu, Nib	30	Cr mc	0.1	Ep-Fe/Cu+Nib 30, Cr 0.1 mc or Ep-Fe/Cu+Nib, Cr mc [7]
			Cu, Nib	30	Cr mp	0.1	Ep-Fe/Cu+Nib 30, Cr 0.1 mp or Ep-Fe/Cu+Nib, Cr mp [7]
		Grade 8	Cu, Nib	50	Cr r	0.1	Ep-Fe/Cu+Nib 50, Cr 0.1 r or Ep-Fe/Cu+Nib, Cr r [8]
			Cu, Nid	35	Cr mc	0.1	Ep-Fe/Cu+Nid 35, Cr 0.1 mc or Ep-Fe/Cu+Nid, Cr mc [8]
			Cu, Nid	35	Cr mp	0.1	Ep-Fe/Cu+Nid 35, Cr 0.1 mp or Ep-Fe/Cu+Nid, Cr mp [8]
		Grade 9	Cu, Nid	50	Cr r	0.1	Ep-Fe/Cu+Nid 50, Cr 0.1 r or Ep-Fe/Cu+Nid, Cr r [9]
			Cu, Nid	45	Cr mc	0.1	Ep-Fe/Cu+Nid 45, Cr 0.1 mc or Ep-Fe/Cu+Nid, Cr mc [9]
			Cu, Nid	45	Cr mp	0.1	Ep-Fe/Cu+Nid 45, Cr 0.1 mp or Ep-Fe/Cu+Nid, Cr mp [9]

Remarks: Each coating thickness of copper-nickel coating shall be as agreed upon between the parties concerned with delivery.

Table 2 C. Classes, grades and symbols

Base metal	Class of coating metal	Grade	Substrate coating	Minimum thickness of substrate coating μm	Finish coating	Minimum thickness of finish coating μm	Symbol
Copper and copper alloy	Nickel-chromium coating	Grade 1	Nib	2	Cr r	0.1	Ep-Cu/Ni 2 b, Cr 0.1 r or Ep-Cu/Nib, Cr r [1]
		Grade 2	Nib	5	Cr r	0.1	Ep-Cu/Ni 5 b, Cr 0.1 r or Ep-Cu/Nib, Cr r [2]
		Grade 3	Nib	10	Cr r	0.1	Ep-Cu/Ni 10 b, Cr 0.1 r or Ep-Cu/Nib, Cr r [3]
		Grade 4	Nib	25	Cr r	0.1	Ep-Cu/Ni 25 b, Cr 0.1 r or Ep-Cu/Nib, Cr r [4]
		Grade 5	Nid	30	Cr r	0.1	Ep-Cu/Ni 30 d, Cr 0.1 r or Ep-Cu/Nid, Cr r [5]
			Nid	25	Cr mc	0.1	Ep-Cu/Ni 25 d, Cr 0.1 mc or Ep-Cu/Nid, Cr mc [5]
			Nid	25	Cr mp	0.1	Ep-Cu/Ni 25 d, Cr 0.1 mp or Ep-Cu/Nid, Cr mp [5]

Table 2 D. Classes, grades and symbols

Base metal	Class of coating metal	Grade	Substrate coating	Minimum thickness of substrate coating μm	Finish coating	Minimum thickness of finish coating μm	Symbol
Zinc alloy	Copper-nickel-chromium coating	Grade 1	Cu, Nib	10	Cr r	0.1	Ep-Zn/Cu+Nib 10, Cr 0.1 r or Ep-Zn/Cu+Nib, Cr r [1]
		Grade 2	Cu, Nib	15	Cr r	0.1	Ep-Zn/Cu+Nib 15, Cr 0.1 r or Ep-Zn/Cu+Nib, Cr r [2]
		Grade 3	Cu, Nib	20	Cr r	0.1	Ep-Zn/Cu+Nib 20, Cr 0.1 r or Ep-Zn/Cu+Nib, Cr r [3]
		Grade 4	Cu, Nib	25	Cr r	0.1	Ep-Zn/Cu+Nib 25, Cr 0.1 r or Ep-Zn/Cu+Nib, Cr r [4]
		Grade 5	Cu, Nib	30	Cr r	0.1	Ep-Zn/Cu+Nib 30, Cr 0.1 r or Ep-Zn/Cu+Nib, Cr r [5]
		Grade 6	Cu, Nib	40	Cr r	0.1	Ep-Zn/Cu+Nib 40, Cr 0.1 r or Ep-Zn/Cu+Nib, Cr r [6]
		Grade 7	Cu, Nib	40	Cr mc	0.1	Ep-Zn/Cu+Nib 40, Cr 0.1 mc or Ep-Zn/Cu+Nib, Cr mc [7]
			Cu, Nib	40	Cr mp	0.1	Ep-Zn/Cu+Nib 40, Cr 0.1 mp or Ep-Zn/Cu+Nib, Cr mp [7]
		Grade 8	Cu, Nib	50	Cr r	0.1	Ep-Zn/Cu+Nib 50, Cr 0.1 r or Ep-Zn/Cu+Nib, Cr r [8]
			Cu, Nid	30	Cr mc	0.1	Ep-Zn/Cu+Nid 30, Cr 0.1 mc or Ep-Zn/Cu+Nid, Cr mc [8]
			Cu, Nid	30	Cr mp	0.1	Ep-Zn/Cu+Nid 30, Cr 0.1 mp or Ep-Zn/Cu+Nid, Cr mp [8]
		Grade 9	Cu, Nid	50	Cr r	0.1	Ep-Zn/Cu+Nid 50, Cr 0.1 r or Ep-Zn/Cu+Nid, Cr r [9]
			Cu, Nid	40	Cr mc	0.1	Ep-Zn/Cu+Nid 40, Cr 0.1 mc or Ep-Zn/Cu+Nid, Cr mc [9]
			Cu, Nid	40	Cr mp	0.1	Ep-Zn/Cu+Nid 40, Cr 0.1 mp or Ep-Zn/Cu+Nid, Cr mp [9]

Remarks: Each coating thickness of copper-nickel coating shall be as agreed upon between the parties concerned with delivery.

Table 2 E. Classes, grades and symbols

Base metal	Class of coating metal	Grade	Substrate coating	Minimum thickness of substrate coating μm	Finish coating	Minimum thickness of finish coating μm	Symbol
Aluminum and aluminum alloy	Nickel-chromium coating	Grade 1	Nib	10	Cr r	0.1	Ep-Al/Ni 10 b, Cr 0.1 r or Ep-Al/Nib, Cr r [1]
		Grade 2	Nib	20	Cr r	0.1	Ep-Al/Ni 20 b, Cr 0.1 r or Ep-Alu/Nib, Cr r [2]
		Grade 3	Nid	30	Cr r	0.1	Ep-Al/Ni 30 d, Cr 0.1 r or Ep-Al/Nid, Cr r [3]
			Nid	25	Cr mc	0.1	Ep-Al/Ni 25 d, Cr 0.1 mc or Ep-Al/Nid, Cr mc [3]
			Nid	25	Cr mp	0.1	Ep-Al/Ni 25 d, Cr 0.1 mp or Ep-Al/Nid, Cr mp [3]
		Grade 4	Nid	50	Cr r	0.1	Ep-Al/Ni 50 d, Cr 0.1 r or Ep-Al/Nid, Cr r [4]
			Nid	35	Cr mc	0.1	Ep-Al/Ni 35 d, Cr 0.1 mc or Ep-Al/Nid, Cr mc [4]
			Nid	35	Cr mp	0.1	Ep-Al/Ni 35 d, Cr 0.1 mp or Ep-Al/Nid, Cr mp [4]

4. Quality

4.1 **Appearance** The appearance of coating, when tested in accordance with 7.1, shall be free from defects harmful to use such as excess degree of exposure, flashing, irregular color, dull deposits, stains, blisters, flaws, pitting, peeling, cracks, exposure of base material and others (*).

Note (*) Though there are some defects in the base material and said defects are not found by an ordinary method, when the defects appear like defects of coating by coating, said appearance shall be judged as agreed upon between the parties concerned with delivery.

4.2 Minimum thickness of coating The minimum thickness of coating, when tested in accordance with 7.2, shall conform to the requirements given in Tables 1 and 2.

4.3 Numbers of micropores and microcracks of coating For microporous chromium coating and microcrack chromium coating, when tested in accordance with 7.3, the number of micropores and microcracks shall be as specified in Table 3.

Table 3. Numbers of micropores and microcracks

Number of micropores of microporous chromium	1000 pieces/cm ² or more
Number of microcracks of microcrack chromium	100 lines/cm ² or more

4.4 Corrosion resistance of coating When the corrosion resistance of coating is tested in accordance with 7.4, corrosion defect of base metal shall be 9 or more in rating number.

Further, in the case of a ferroxyl test, the number of spots per 1 cm² shall be less than 5.

4.5 Adhesion of coating When the adhesion of coating is tested in accordance with 7.5, the coating shall be free from peeling or blistering of coating.

5. Stress relieving before coating

Where heating treatment of stress relieving is required before coating for steel base material, copper alloy base material, etc., said conditions shall be determined as agreed upon between the parties concerned with delivery.

6. Hydrogen embrittlement relieving after coating

Where heating treatment of hydrogen embrittlement relieving for steel products is required, it shall be started within 4 h after coating.

Further, treating temperature shall be 190 to 230°C, and appropriate treating temperature and treating time shall be determined as agreed upon between the parties concerned with delivery ⁽⁵⁾.

Note ⁽⁵⁾ Where the degree of hydrogen to be removed differs occasionally according to the thickness of the coating, an appropriate treating temperature shall be respectively established.

7. Tests

7.1 Appearance test The appearance test shall be as specified in Annex 1.

7.2 Thickness test The thickness test shall be in accordance with any one of the coating thickness measurement by microscope, coulometric thickness test, fluorescent X-ray spectrometric method for measuring thickness, beta black-scatter method for measuring thickness, over current test method, or mass method, which are specified in JIS H 8501.

7.3 Micropore and microcrack test The micropore and microcrack test of chromium coating shall be as specified in Annex 2.

7.4 Corrosion resistance test The corrosion resistance test shall be in accordance with any one of the neutral salt spray test methods, CASS test method, acetic acid acidic salt spray test method, corrodokote test method which are specified in JIS H 0502, or the ferroxyl test method as given in Annex 3. However, test time and appearance variation in the acetic acid acidic salt spray test and corrodokote test shall be determined as agreed upon between the parties concerned with delivery.

(1) Neutral salt spray test The neutral salt spray test shall be performed continuously for the time as specified in Table 4.

Table 4. Spraying time

Unit: h

Base metal	Class of coating metal	Grade	Neutral salt spray test	CASS test	Ferroxyl test	Service environment
Steel	Copper-nickel coating	Grade 1			○ ⁽⁶⁾	D
		Grade 2			○ ⁽⁶⁾	D
		Grade 3	24			D
		Grade 4	24			D
		Grade 5	24			D
Copper and copper alloy	Nickel coating	Grade 1	24			D
		Grade 2	24			D
		Grade 3	24			D
Steel	Nickel-chromium coating and copper-nickel-chromium coating	Grade 1		4		D
		Grade 2		4		D
		Grade 3		4		D
		Grade 4		8		C
		Grade 5		8		C
		Grade 6		16		B
		Grade 7		16		B
		Grade 8		16		B
		Grade 9		24		A
Copper and copper alloy	Nickel-chromium coating	Grade 1		4		D
		Grade 1		8		C
		Grade 2		8		C
		Grade 3		16		B
		Grade 4		16		B
		Grade 5		24		A

Table 4 (Cont'd)

Base metal	Class of coating metal	Grade	Neutral salt spray test	CASS test	Ferroxyl test	Service environment
Zinc alloy	Copper-nickel-chromium coating	Grade 1		4		D
		Grade 2		4		D
		Grade 3		8		C
		Grade 4		8		C
		Grade 5		16		B
		Grade 6		16		B
		Grade 7		16		B
		Grade 8		16		B
		Grade 9		24		A
Aluminium and aluminium alloy	Nickel-chromium coating	Grade 1		4		D
		Grade 2		8		C
		Grade 3		16		B
		Grade 4		24		A

Note (6) The item with the mark ○ is evaluated by executing said test.

Remarks: The service environment shall be in accordance with the classification as given in Annex 4.

(2) CASS test The CASS test shall be carried out continuously for the time as specified in Table 4.

(3) Ferroxyl test The ferroxyl test shall be executed as specified in Annex 3.

7.5 Adhesion test The adhesion test shall be carried out by the method specified in JIS H 8504.

8. Inspection

The inspection shall be carried out as follows:

- (1) The coating shall be tested in accordance with 7. and the coating conforming to the requirements specified in 4. shall be accepted.
- (2) The test piece shall be sampled from a lot of the same parts in accordance with JIS Z 9031.

Remarks 1. The inspection item and the test method shall be selected as agreed upon between the parties concerned with delivery.

2. The number of test pieces, the order of inspection, the inspection objective position and the substitute use of test pieces shall be as agreed upon between the parties concerned with delivery.

9. Designation

The constitution of coating shall be designated by the order of the class of coating, base metal, class of coating metal, and minimum thickness or grade of coating.

Example 1. For 2 μm electroplated coating of copper and 3 μm electro-gloss nickel coating on steel base

Ep-Fe/Cu 2, Ni 3 b

Example 2. For electroplated coating of copper, electrogloss nickel coating, and general chromium coating Grade 3 on steel base

Ep-Fe/Cu, Nib, Cr r [3]

10. Marking

The coating shall be marked on the invoice with the following peculiarities.

- (1) Class and grade or their symbols
- (2) Working date or its abbreviation
- (3) Name of processor or its abbreviation

Annex 1. Appearance test method

1. Scope

This Annex 1 specifies the appearance test method of nickel coating and nickel-chromium coating.

Remarks: This test examines the quality of the degree of gloss, flashing, irregular color, dull deposit, stain, blister, flaw, pit, peeling, crack, smoothness, the presence of exposure of base material or substrate coating, etc.

2. Test condition

The test shall be conducted under a black or similarly dark background ⁽¹⁾ by using a standard white light as specified in JIS Z 8902 or that equivalent in performance thereto, giving approximately 300 lux in illuminance to a test surface to transmit a ground glass and illuminating.

Note ⁽¹⁾ The background is the gray or as colorless as possible background of brown kraft paper or the like.

3. Operation

For the operation install a sample under a state wherein it is usually used, separate by a range of clear vision from the test surface under conditions of 2. and visually observe by an as natural posture as possible.

Annex 2. Measuring method for micropore and microcrack of chromium coating

1. Scope

This Annex 2 specifies the method for examining of micropore and microcrack of chromium coating applied on nickel.

2. Summary

This test shall be the method as follows, plate copper coating on a chromium coating surface, observe the distributed state of copper deposited on the coating surface, and examine the number of micropores or microcracks of chromium coating.

3. Measuring instrument

The measuring instrument shall be composed as follows:

- (1) Small d.c. power source
- (2) Electrolytic bath
- (3) Copper plate

4. Test liquid

For the test liquid, the solution ⁽¹⁾ containign 200 g of copper sulfate extra grade as specified in JIS K 8983 and 20 g (10.9 ml) sulfuric acid extra grade as specified in JIS K 8951 per 1000 ml of pure water shall be used.

Note ⁽¹⁾ Where 1000 ml of test liquid is prepared, preliminarily sample 600 to 700 ml of pure water into a beaker, dissolve specified chemicals therein, transfer total amount to a flask or the like, and add pure water to the mark to make 1000 ml.

5. Operation

The operation shall be as follows:

- (1) Fill an electrolytic bath with test liquid, oppose a copper plate to a sample, and dip. For the sample for which 24 h or over has elapsed after plating, dip into 10 to 20 g/l nitric acid solution at 65°C before dipping into the electrolytic bath, and remove the oxide film. After washing with water, apply to the test.
- (2) Then, connect the copper plate to the positive side of a power source and the sample to the negative side, and plate copper coating ⁽³⁾ by electrolyzing ⁽²⁾ for 1 min by 30 A/m² in cathode current density at 20 ± 5°C temperature.
- (3) Take the sample out without touching the test surface by the fingers. After washing with water, dry.

- (4) Observe the test surface visually ⁽⁴⁾ or with a 100 to 200 magnification microscope, and examine the number of micropores or microcracks from a state of deposited copper coating.

Notes ⁽²⁾ Do not stir during electrolysis.

- (³) Copper is deposited only on the part of micropore or microcrack of chromium coating.
- (⁴) It will suffice to judge by comparing with the micropore or microcrack standard piece (for instance, 5 × 5 cm size) of preliminarily copper plated chromium coating.

Annex 3. Ferroxyl test method

1. Scope

This Annex 3 specifies the method for examining the corrosion resistance of the copper-nickel coating, nickel-chromium coating, and copper-nickel-chromium coating electroplated on steel base by a ferroxyl test.

2. Summary

This test shall be the method for examining the blue spot of iron complex ion presented on filter paper which is peeled 5 min after sticking the filter paper moistened with test liquid to the significant surface of coating.

3. Test liquid

The test liquid shall have the following composition.

Put 600 to 800 ml of pure water ⁽¹⁾ into a resin or glass vessel. Then, after dissolving successively 10 g of potassium ferrocyanide extra grade as specified in JIS K 8802, 10 g of potassium ferrocyanide extra grade as specified in JIS K 8801, and 60 g of sodium chloride extra grade as specified in JIS K 8150, dilute the total amount with pure water to 1000 ml.

Note ⁽¹⁾ The volume resistivity of pure water shall be $50 \times 10^4 \Omega \cdot \text{cm}$ or over.

4. Test piece

The test piece shall be as follows:

4.1 Sampling of test piece The test piece shall be sampled from the significant surface of a product and otherwise shall be the product itself. Where a test can not be executed on the product, the procedure shall be determined as agreed upon between the parties concerned with delivery.

4.2 Shape The standard area of a test piece shall be 10 cm² or over.

5. Operation

Sufficiently wipe a test piece with solvent of ethyl alcohol or the like, and otherwise apply fine powder of magnesium oxide or sedimentating calcium carbonate to absorbent cotton moistened with water. Rub the test surface therewith. Then, after washing with water, wipe water content with a clean cloth or blotting paper. Thereafter, use close qualitative filter paper Class 2 as specified in JIS P 3801 as test paper ⁽²⁾, dip into test liquid, and stick the wetted test paper as it is to the test surface. Peel-off test paper 5 min later. After washing with water, blot water content, and examine the number of blue spots ⁽³⁾ presented on the test paper.

Notes ⁽²⁾ The area of test paper shall be 10 cm² or over. When the surface area of a product does not come up to that size or when the surface is curved, smaller test paper may be used.

⁽³⁾ Brown or yellow spots occasionally appear. However, they shall not be the subject of inspection.

6. Calculation

Take 1 cm² area of test paper as a unit, and calculate the number of spots according to the size of the spot as follows (⁴):

Spot of under 1 mm diameter Mark nubmer per spot, 1
 Spot of 1 mm or over to and excluding 3 mm Mark number per spot, 3
 Spot of 3 mm or over to and excluding 5 mm Mark number per spot, 10

Example: Assuming that the 10 cm² area test paper contains

3 spots of under 1 mm diameter

2 spots of 1 mm or over to and excluding 3 mm and

1 spot of 3 mm or over to and excluding 5 mm diameter,

the mark number per 1 cm² shall be

$$\frac{1 \times 3 + 3 \times 2 + 10 \times 1}{10} = 1.9$$

Note (⁴) When any spot of 5 mm or over diameter is generated, said test paper shall be rejected.

Annex 4. Service environment of coating

1. Scope

This Annex 4 specifies the severity of condition to be confronted with under environment wherein an electroplated product is used (hereafter referred to as the "service environment").

2. Service environment

The service environment shall be as given in Annex 4 Table 1.

Annex 4 Table 1.

Service environment	Service environment condition	Informative reference
A	Strong corrosive outdoor environment	Seashore, industrial area, etc.
B	Ordinary outdoor environment	Fields and gardens, residential district, etc.
C	Damp indoor environment	Bath room, kitchen, etc.
C	Ordinary indoor environment	Dwelling, office, etc.