

JIS

JAPANESE INDUSTRIAL STANDARD

**Recommended practice for
anodizing on aluminium and
aluminium alloys**

JIS H 9500—1992

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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Recommended practice for anodizing
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1. Scope

This Japanese Industrial Standard specifies the recommended practice for treating anodic oxide coating (hereafter referred to as the "coating") on the surfaces of malleable material, casting material, etc. as basic material of aluminium and aluminium alloys for the purposes of surface protection, decoration, etc.

Remarks: Applicable Standards to this Standard are shown in the following:

JIS H 0201-Glossary of Terms Used in the Surface Treatment of Aluminium

JIS H 4000-Aluminium and Aluminium Alloy Sheets and Plates, Strip and Coiled Sheets

JIS H 4040-Aluminium and Aluminium Alloy Rods, Bars, and Wires

JIS H 4080-Aluminium and Aluminium Alloy Seamless Pipes and Tubes

JIS H 4090-Aluminium and Aluminium Alloy Welded Pipes and Tubes

JIS H 4100-Aluminium and Aluminium Alloy Extruded Shapes

JIS H 4140-Aluminium and Aluminium Alloy Forgings

JIS H 5202-Aluminium Alloy Castings

JIS H 5302-Aluminium Alloys Die Castings

JIS K 8005-Standard Substances for Volumetric Analysis

JIS P 3801-Filter Paper (for Chemical Analysis)

2. Definitions

For the purposes of this Standard, main definitions are in accordance with JIS H 0201 and otherwise the following definitions apply:

- (1) anodizing adaptability Adaptability of anodizing corresponding to the purposes of aluminium and aluminium alloys.
- (2) stain resistance The resistance to staining. It is expressed by the degree of sealing.
- (3) anodic oxidation The electrolysis in electrolytic solution with using the basis material as the anode.

- (4) anodizing The process from anodic oxidation until sealing of anodic oxide coating.

3. Basis materials

The basis materials shall be as follows:

- (1) Classes of basis materials are those specified in JIS H 4000, JIS H 4040, JIS H 4080, JIS H 4090, JIS H 4100, JIS H 4140, JIS H 5202 and JIS H 5302, or the materials equivalent thereto in chemical composition. Among these basis materials the anodizing adaptability of main materials are shown in Table 1, and the influences of main alloy composition to the coating property are shown in Table 2.

Table 1. Anodizing adaptability of main aluminium and the alloys

Alloy No. (flattened material)	Purposes of anodizing				Alloy No. (casting material)	Purposes of anodizing			
	Corrosion prevention	Dyeing	Bright	Wear resistance		Corrosion prevention	Dyeing	Bright	Wear resistance
1080	A	A	A	A	AC1B	C	C	D	C
1070	A	A	A	A	AC2A	C	D	D	C
1050	A	A	A	A	AC3A	B	D	D	B
1100	A	A	A	A	AC4B	C	D	D	C
					AC4C	B	D	D	C
2011	C	C	D	C	AC5A	C	C	D	C
2014	C	C	D	C	AC7A	A	A	B	A
2017	C	C	D	C	AC8A	C	D	D	C
2024	C	C	D	C	AC9A	C	D	D	C
3003	A	B	C	A	ADC 1	C	D	D	C
3004	A	B	C	A	ADC 3	B	D	D	B
					ADC 5	A	A	B	A
4043	B	B	D	B	ADC 6	A	B	B	A
					ADC10	C	D	D	C
5005	A	A	B	A	ADC12	C	D	D	C
5052	A	A	B	A					
5056	A	A	C	A					
5083	A	A	C	A					
5N01	A	A	A	A					
6061	A	A	C	A					
6063	A	A	B	A					
6N01	A	A	C	A					
7075	B	B	C	B					
7N01	B	B	C	B					

Remarks: Anodizing adaptability A : superior,
B : good, C : acceptable
D : difficult

Table 2. Influences of main alloy composition to coating properties
(Sulfuric-acid bath electrolysis)

Alloy composition	Coating property
Silicone	Opacification, coloring (gray-black color), uneven thickness
Copper	Opacification, uneven thickness
Manganese	Opacification, coloring (pale yellow color)
Chromium	Opacification, coloring (yellow color)
Iron	Opacification
Magnesium	Opacification, if addition is large in amount
Zinc	No remarkable influence

- (2) The basis materials must be, as a rule, those confirmed with class, chemical composition, manufacturing method or individual quality.
- (3) The basis materials are to be uniform in quality and have no defects harmful to use.

4. Pretreatment

4.1 Classification of pretreatments Classes of pretreatments shall be as follows:

- (1) Mechanical polishing Polish mechanically the surface of basis material in order to form the uniform flat, smooth surface or the surface condition required the suitable rough surface or the like. As to mechanical polishing methods there are abrasive cloth (paper) polishing, brush polishing, buff polishing, steel-wool polishing, sand blasting, liquid honing, barrel polishing, etc., and the characteristic finished surfaces are formed respectively and therefore the polishing method suitable for the purpose should preferably be selected.
- (2) Degreasing The degreasing is carried out to remove the working oil, rust preventive oil and other stains to cause bad influence to anodizing by adhering on the surface of basis material. The degreasing methods, include organic solvent method, surface-active agent method, sulphuric acid method, electrolytic degreasing method, alkali degreasing method, emulsion degreasing method, phosphate method, etc., and the example is shown in Table 3.

Further, because the degreasing performances are different according to the class of adhered oil, cares are to be taken for selection of degreasing method.

Further, for improving the cleaning effect, air stirring, vibration by ultrasonic wave, etc., may be utilized.

Table 3. Example of degreasing method

Classification	Treating solution	Treating conditions		Remarks
		Temperature °C	Time s	
Organic solvent method	Benzene, gasoline, ketones, etc.	Ordinary temperature	Adequately	Without corrosion
Surface-active agent method	Soap, neutral detergent, composite agent of these	Ordinary temperature to 80	Adequately	Without corrosion
Sulphuric-acid method	50 to 250 g// sulphuric acid	Ordinary temperature to 80	30 to 600	
Electrolytic degreasing method	10 to 20 g// sodium hydroxide	Ordinary temperature	Adequately	Make the material to be treated as the cathode, and flow the current of 400 to 800 A/m ² . Desmutting is required.
	50 to 250 g// sulphuric acid	Ordinary temperature	Adequately	Electrolyze by a.c. or by taking the material to be treated as cathode.
Alkali degreasing method	30 to 200 g// sodium hydroxide	Ordinary temperature to 80	5 to 60	Sodium phosphate and the like may be added. Desmutting is required.
Emulsion degreasing method	Mixture of gas oil, kerosene, surface-active agent, water, etc.	Ordinary temperature to 80	Adequately	Immersion or spray. Without corrosion
Phosphate method	Mixture of phosphates, sodium carbonate, surface-active agent, etc.	Ordinary temperature to 70	30 to 600	Without corrosion

- (3) Removing of oxides Removing of oxides is the treatment to immerse into acidic or alkaline aqueous solution, to remove the oxide film on the basic material surface, if necessary and the examples are shown in Table 4.

Table 4. Examples of oxide removing methods

Classifi- cation	Composition of treating solution	Treating conditions	
		Temperature °C	Time s
Phosphoric acid - chromic acid method	2.5 to 4.5 vol % phosphoric acid (density 1.697 g/cm ³) 20 to 40 g/l anhydrous chromic acid	60 to 70	Adequately
Alkaline method	10 to 20 g/l sodium hydroxide	Ordinary temperature	Adequately

- (4) Etching Etching is the treatment for the basis material to immerse into acid or alkali water solution in order to make the surface state of product uniform and to give visual sensitive effect, which dissolve the surface of basic material uniformly and make micro-fine ragged surface condition. Example of etching method is as shown in Table 5.

Table 5. Example of etching method

Classifi- cation	Composition of treating solution	Treating conditions		Remarks
		Temperature °C	Time s	
Phosphoric- acid alkali method	30 to 80 g/l sodium hydroxide 50 to 100 g/l sodium phosphate	Ordinary temperature	Adequately	Desmutting is required.
Sulphuric acid - chromic acid method	30 to 150 g/l sulphuric acid 20 to 100 g/l anhydrous chromic acid	60 to 70	Adequately	Removing of oxides is required.
Alkali method	30 to 200 g/l sodium hydroxide	Ordinary temperature to 90	20 to 600	Desmutting is required.

- (5) Desmutting Desmutting is the treatment to remove the smutt (dissolution residue) adhering on the surface after degreasing treatment or etching treatment and is treated by immersing in usually 100 g/l or more nitric acid or sulphuric acid water solution for several 10 s or several min.

- (6) Electrolytic polishing or chemical polishing The electrolytic polishing or chemical polishing is the treatment to be carried out for obtaining high-glazed surface of basis material, which polishes electrochemically or chemically by dissolution treatment in acid or alkali water solution. Examples of electrolytic polishing method are shown in Table 6 and examples of chemical polishing methods are shown in Table 7.

Table 6. Examples of electrolytic polishing methods

Classification	Composition of treating solution	Treating conditions				Remarks
		Electric current density A/m ²	Bath voltage V	Temperature °C	Time min	
Phosphoric-acid method	85 to 100 vol % phosphoric acid (density 1.697 g/cm ³)	2000 to 8000	20 to 30	50 to 80	4 to 20	In vibration method it becomes mirror plane, but in standing-still method it becomes mat finish. Removing of oxides is required.
Phosphoric acid-sulphuric acid method	50 to 60 vol % phosphoric acid (density 1.697 g/cm ³) 20 to 40 vol % sulphuric acid (density 1.840 g/cm ³)	500 to 5000	10 to 30	60 to 80	1 to 20	The same as above.
Alkali method	150 g/l anhydrous sodium carbonate 50 g/l sodium phosphate	300 to 2000	5 to 15	70 to 90	2 to 10	Desmutting is required.

Table 7. Examples of chemical polishing methods

Classification	Composition of treating solution	Treating conditions		Remarks
		Temperature °C	Time s	
Phosphoric acid-nitric acid method	40 to 80 vol % phosphoric acid (density 1.697 g/cm ³) 2 to 10 vol % nitric acid (density 1.42 g/cm ³)	80 to 100	30 to 240	If a small amount of urea is added, the generating nitrogen oxide gas is restricted.
Phosphoric acid-nitric acid-acetic acid method	60 vol % phosphoric acid (density 1.697 g/cm ³) 20 vol % nitric acid (density 1.42 g/cm ³) 20 vol % acetic acid (density 1.06 g/cm ³)	100 min.	Adequately	
Phosphoric acid-acetic acid-copper salt method	70 to 80 vol % phosphoric acid (density 1.697 g/cm ³) 3 to 5 vol % nitric acid (density 1.42 g/cm ³) 5 to 15 vol % acetic acid (density 1.06 g/cm ³) 0.5 to 10 g/l copper (II) chloride	90 min.	60 to 300	

- (7) Water washing Water washing is the treatment to be carried out in preprocess in order to make the basic surface clean by removing the remaining treating liquid and residue on the basic surface, it should preferably be performed so as the overall surface of material to be treated to be washed uniformly in running water.

Further, when the shower water washing is used together, the cleaning effect is improved.

Further, the washing water is brought into the treating liquid of the next process and therefore it should preferably be such water quality as not to cause interference to control of treating liquid of the next process.

4.2 Process of pretreatment As to the process of pretreatment, corresponding to surface state of product required, either one of the following processes shall be taken as the reference. However, according to the specifications of surface state, pretreatment process other than the process indicated herein may be used.

- (1) Degreasing - water washing
- (2) Degreasing - water washing - etching - water washing - desmutting - water washing
- (3) Mechanical polishing - degreasing - water washing
- (4) Mechanical polishing - degreasing - water washing - etching - water washing - desmutting - water washing
- (5) Degreasing - water washing - electrolytic polishing or chemical polishing - water washing - removing of oxides or desmutting-water washing
- (6) Mechanical polishing - degreasing - water washing - electrolytic polishing or chemical polishing - water washing - removing of oxides or desmutting - water washing

4.3 Procedure after pretreatment The pretreated basis material shall, as a rule, be processed in anodizing immediately.

4.4 Control of pretreatment In the pretreatment process indicated in 4.2, relating to each pretreatment such as bath composition, treatment temperature, treatment time, etc., the control reference shall be specified concretely, depending upon the characteristics of material to be treated, and usually the adequate control shall be performed by using respectively required control facility and appliances ⁽¹⁾.

Note ⁽¹⁾ The chemical analysis apparatus, pH-meter, hydrometer, thermometer, etc.

5. Jig attaching

5.1 Appliances for jig Appliances for jig shall comply with the following requirements.