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Anodic oxide coatings on aluminium and aluminium alloys

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Descriptors : anodic coating, electrodeposition, oxidation methods, aluminium, aluminium alloys, non-ferrous alloys, anodizing

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently, **JIS H 8601 : 1992** is replaced with **JIS H 8601 : 1999**.

This revision is based on **ISO 7599 : 1983** *Anodizing of aluminium and its alloys—General specifications for anodic oxide coatings on aluminium*, in order to expedite the comparison of international conformity between the Japanese Industrial Standard and International Standard and make the Japanese Industrial Standard in compliance with the International Standard.

In **JIS H 8601**, the following Annexes are included.

In Annex 1 (informative), the general specification for anodizing adaptability and qualities of anodic oxide coatings on aluminium and aluminium alloys specified in **ISO 7599** and **JIS H 9500** is described. In Annex 2 (informative), the recommended practice for anodizing on aluminium and aluminium alloys specified in **JIS H 9500** is described.

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Anodic oxide coatings on aluminium and aluminium alloys

Introduction This Japanese Industrial Standard has been prepared based on the first edition of **ISO 7599 : 1983** *Anodizing of aluminium and its alloys—General specifications for anodic oxide coatings on aluminium* without any modification in technical content for the corresponding parts. The some items not specified in the corresponding International Standard (such as, characteristic properties, and quality) on the quality, have been additionally contained herein as Japanese Industrial Standard.

The parts underlined with dots are the matters not included in the corresponding International Standard.

1 Scope This Japanese Industrial Standard is a general specifications for the anodic oxide coatings (hereafter referred to as "coatings") on aluminium and aluminium alloys, and specifies qualities and test methods. However, except the following coatings.

- a) Non-porous oxide coatings of the barrier layer type.
- b) Oxide coatings intended merely to prepare the substrate for subsequent application of organic coatings or electrodeposition of metals.
- c) Hard anodic oxide coatings specified in **JIS H 8603**.

Remarks : The corresponding International Standard to this Standard is as follows:

ISO 7599 : 1983 *Anodizing of aluminium and its alloys—General specifications for anodic oxide coatings on aluminium*

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

JIS H 0201 *Glossary of terms used in the surface treatment of aluminium*

JIS H 8603 *Hard anodic oxidation coatings on aluminium and its alloys for engineering purposes*

JIS H 8680-1 *Test methods for thickness of anodic oxide coatings on aluminium and aluminium alloys—Part 1 : Microscopical method*

JIS H 8680-2 *Test methods for thickness of anodic oxide coatings on aluminium and aluminium alloys—Part 2 : Eddy current method*

JIS H 8680-3 *Test methods for thickness of anodic oxide coatings on aluminium and aluminium alloys—Part 3 : Non-destructive measurement by split-beam microscope*

JIS H 8681-1 *Test methods for corrosion resistance of anodic oxide coatings on aluminium and aluminium alloys—Part 1 : Alkali resistance test*

- JIS H 8681-2 *Test methods for corrosion resistance of anodic oxide coatings on aluminium and aluminium alloys—Part 2 : CASS test*
- JIS H 8682-1 *Test methods for abrasion resistance of anodic oxide coatings on aluminium and aluminium alloys—Part 1 : Wheel wear test*
- JIS H 8682-2 *Test methods for abrasion resistance of anodic oxide coatings on aluminium and aluminium alloys—Part 2 : Abrasive jet test*
- JIS H 8682-3 *Test methods for abrasion resistance of anodic oxide coatings on aluminium and aluminium alloys—Part 3 : Sand-falling abrasion resistance test*
- JIS H 8683-1 *Test methods for sealing quality of anodic oxide coatings on aluminium and aluminium alloys—Part 1 : Dye spot test method*
- JIS H 8683-2 *Test methods for sealing quality of anodic oxide coatings on aluminium and aluminium alloys—Part 2 : Phosphoric-chromic acid solution immersion test method*
- JIS H 8683-3 *Test methods for sealing quality of anodic oxide coatings on aluminium and aluminium alloys—Part 3 : Admittance test method*
- JIS H 8684 *Test method for resistance of anodic oxidation coatings on aluminium and aluminium alloys to cracking by deformation*
- JIS H 8685-1 *Accelerated test methods for light fastness of coloured anodic oxide coatings on aluminium and aluminium alloys—Part 1 : Test for light fastness to artificial light*
- JIS H 8685-2 *Accelerated test methods for light fastness of coloured anodic oxide coatings on aluminium and aluminium alloys—Part 2 : Test for light fastness to ultra-violet light*
- JIS H 8686-1 *Test methods for image clarity of anodic oxide coatings on aluminium and aluminium alloys—Part 1 : Chart scale method*
- JIS H 8686-2 *Test methods for image clarity of anodic oxide coatings on aluminium and aluminium alloys—Part 2 : Instrumental method*
- JIS H 8687 *Test methods for dielectric strength of anodic oxidation coatings on aluminium and aluminium alloys*
- JIS H 8688 *Test method for determination of mass per unit area of anodic oxide coatings on aluminium and aluminium alloys—Gravimetric method*
- JIS H 8689 *Test method for continuity of anodic oxide coatings on aluminium and aluminium alloys—Copper sulphate test*
- JIS Z 2371 *Methods of neutral salt spray testing*
- JIS Z 8741 *Specular glossiness—Methods of measurement*
- JIS Z 9112 *Classification of fluorescent lamps by chromaticity and colour rendering property*

3 Definitions The definitions of main terms used in this Standard shall be in accordance with JIS H 0201.

4 Quality specification for anodizing adaptability and qualities of anodic oxide coatings on aluminium and aluminium alloys Quality specification for anodizing adaptability and qualities of anodic oxide coatings on aluminium and aluminium alloys is shown in Annex 1 (informative).

5 Recommended practice A party concerned with treating anodic oxide coating on aluminium and aluminium alloys shall specify the standard for the recommended practice which is needed to keep the quality of the coatings and shall deal with the process. Annex 2 (informative) should be referred when the recommended practice is provided.

6 Characteristic properties and quality Characteristic properties and quality of the coatings are shown in 6.1 to 6.12. Characteristic properties and quality needed to the target product shall be agreed with taking account of its application. The important characteristic properties and applications which are needed commonly are given in Table 1.

Unless otherwise agreed upon between the parties concerned with delivery, test items in division of using environment in Table 1 and the requirement specified in each quality item shall be employed. Other quality items shall be agreed between the parties concerned with delivery, if necessary, when only special application may be required. Test shall be carried out in accordance with the method specified in 7.

Table 1 Test items in division of using environment

Using environ- ment	Example of applications	Appear- ance and color	Coat- ing thick- ness	Corrosion resistance		Abrasion resistance	Sealing quality
				Alkali corrosion resistance	CASS corrosion resistance		
				Alkali spot test or alkali resistance test by electro-motive force	CASS test		
Dry-wet, heat cooling	Kitchen wares (heat-ing vessel) such as kettle, pan, etc.	○	○	○	—	○	—
Wet-humidity, friction	Daily utensils such as sink, washbasin, etc.	○	○	○	—	○	—
Dry, friction	Building members (indoor), vehicle internal parts, furniture members, etc.	○	○	—	—	○	○
Dew formation, atmos- pheric exposure	Building members, (outdoor), vehicle external parts, parts for ships, etc.	○	○	—	○	○	—
Dry	Ornaments, reflecting mirror, home electrical appliances, etc.	○	○	—	○	—	○

- Remarks 1 The test shall be carried out for the coating colored.
- 2 The test items related to the coating, of which the division of environment in use are not clear, shall be in accordance with the agreement between the parties concerned with delivery.

6.1 Appearance and color

6.1.1 Appearance The appearance of coating shall be free from detrimental defects to use such as damage, surface irregularity, powdering etc. on the significant surface. For the quality of the appearance, the standard sample or the boundary sample may be employed with the agreement between the parties concerned with delivery, if necessary.

6.1.2 Color and range of its tolerance Color and range of its tolerance shall be decided with the agreement between the parties concerned with delivery. The qualities of color and range of its tolerance may employ the standard sample or the boundary sample with the agreement between the parties concerned with delivery, if necessary.

6.2 Thickness of the coatings

6.2.1 Classification of the coating thickness The thickness of the coatings shall be expressed by the average thickness (μm) of the coatings and shall comply with Table 2.

The class of the coating thickness shall be selected in consideration of the application of products and environment in use, and in accordance with Table 2, unless otherwise agreed upon between the parties concerned with delivery.

Table 2 The classification of the coating thickness

Class	AA3	AA5	AA6	AA10	AA15	AA20	AA25
Average thickness μm	3.0 min.	5.0 min.	6.0 min.	10.0 min.	15.0 min.	20.0 min.	25.0 min.

Remarks : There shall not be the coating thickness of less than 80 % of the average coating thickness specified at the measuring point.

6.2.2 Class of the coating thickness and main applications Class of the coating thickness shall be selected in consideration of the application of products and environment in use, and in accordance with Table 3, unless otherwise agreed upon between the parties concerned with delivery.

If a particular thickness of the coating is required according to application, an average thickness other than those specified in Table 2 may be employed.

Table 3 Examples of the main application for each class of the coating thickness

Class of coating thickness	Main application
AA3	Reflection plate, parts for electric appliances (internal sealing), etc.
AA5 AA6 AA10	Kitchen utensils, daily utensils, parts for electric appliances, ornaments, vehicle internal parts, furniture members, building members (indoor), etc.
AA15 AA20 AA25	Kitchen wares, vehicle external parts, civil and architectural engineering members (outdoor), ship parts, etc.

Remarks : If it is necessary for application, the minimum coating thickness may be agreed upon between the parties concerned with delivery, regardless of the class for average coating thickness.

6.3 Corrosion resistance Corrosion resistance of the coatings is defined as the characteristic property against various kind of environment and may be required characteristic properties which withstand in the acidic, alkaline environments and in atmosphere of salt water according to the application. However, the quality of corrosion resistance on the coatings shall conform to those in Table 4 or Table 5.

Table 4 Alkali corrosion resistance

Class	Alkali spot test or alkali resistance test by electromotive force	
	Type A ⁽¹⁾ s	Type B ⁽¹⁾ s
AA3	—	—
AA5	—	—
AA6	30 min.	90 min.
AA10	50 min.	150 min.
AA15	75 min.	225 min.
AA20	100 min.	300 min.
AA25	125 min.	375 min.

Note ⁽¹⁾ Type A and type B are divided according to the difference of those properties.

Remarks : The class AA20 and upwards of coatings shall be tested by alkali resistance test by electromotive force and shall not be tested by alkali spot test.

Table 5 CASS corrosion resistance

Class	CASS test	
	Test hour h	Rating number RN
AA3	—	—
AA5		
AA6	8	9 min.
AA10	16	
AA15	32	
AA20	56	
AA25	72	

6.4 Abrasion resistance Abrasion resistance of the coatings is defined as the characteristic property against the abrasion environment, and may be required characteristic properties which withstand abrasion environment such as abrasion by collision of abrasion materials, moving abrasion, rolling friction according to the application. The quality of abrasion resistance on the coatings shall conform to any one given in Table 6.

Abrasion resistance by the abrasive jet test shall be carried out with conducting check method and expressed with abrasion time $[W_j (T)]$ by the substrate surface is bared.

Table 6 Abrasion resistance

Class	Sand-falling abrasion resistance test s	Abrasive jet test s	Abrasive wheel wear test ds/μm ⁽²⁾
AA3	—	—	—
AA5			30 min.
AA6	150 min.		
AA10	500 min.	24 min.	
AA15	750 min.	36 min.	
AA20	1 000 min.	48 min.	
AA25	1 250 min.	60 min.	

Note ⁽²⁾ The number of times of reciprocating motion required for abrasion of 1 μm of the coatings.