

Translated English of Chinese Standard: GB/T23612-2017

www.ChineseStandard.net → Buy True-PDF → Auto-delivery.

Sales@ChineseStandard.net

GB

NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA

ICS 25.220.01
H 61

GB/T 23612-2017

Replacing GB/T 23612-2009

Technical Specification for Process of Anodizing and Electrodeposition Painting on Aluminum Alloy Extruded Profiles for Architecture

铝合金建筑型材阳极氧化与阳极氧化电泳涂漆工艺技术规范

Issued on: July 12, 2017

Implemented on: April 1, 2018

Issued by: General Administration of Quality Supervision, Inspection and
Quarantine;

Standardization Administration of the People's Republic of
China.

Table of Contents

Foreword	3
1 Scope	6
2 Normative References	6
3 Terms and Definitions	7
4 Typical Process Flow Chart	7
5 Equipment Requirements	8
6 Quality Requirement of Mill Finish Profiles	13
7 Manufacturing Process Requirements	13
8 Monitoring of Process Parameters	22
9 Product Quality Control	23

Foreword

This Standard was drafted in accordance with the rules in GB/T 1.1-2009.

This Standard serves as a replacement of GB/T 23612-2009 Anodizing and Electrophoretic Painting Technical Specification on Wrought Aluminum Alloy Extruded Profiles for Architecture. In comparison with GB/T 23612-2009, except from editorial modifications, there are several main technical changes as follows:

- The typical process flow chart is transferred to the space prior to equipment requirements (please refer to Chapter 4; 6.1.5 in Version 2009);
- In the typical process flow chart on anodizing (Figure 1), a rinsing process is added between neutralization and dyeing; a rinsing process is added between hole sealing and cold sealing post-treatment. Direct connection to water rinsing 1 after electrolytic coloring through the process of anodizing without electrolytic coloring is modified into direct connection to the process of hole sealing through water rinsing 2 after the process of anodizing (please refer to Chapter 4; 6.1.5 in Version 2009);
- In the typical process flow chart on anodizing electrophoretic painting (Figure 2), direct connection to water rinsing 1 after electrolytic coloring through the process of anodizing without the process of electrolytic coloring is modified into direct connection to hot water rising before electrophoretic painting through water rinsing 2 after the process of anodizing (please refer to Chapter 4; 6.1.5 in Version 2009);
- The stipulations regarding the processing of groove materials are modified (please refer to 5.1.1.2; 4.1.1.1 in Version 2009);
- The requirements towards anodizing electrolyte agitation equipment are modified (please refer to 5.1.3; 4.1.3 in Version 2009);
- The requirements towards anodizing power supply are modified (please refer to 5.1.5.2; 4.1.5.2 in Version 2009);
- The requirements towards automatic fault diagnosis and protection system for anodizing power supply unit are added (please refer to 5.1.5.3);
- The process of installing recovery unit is modified (please refer to 5.1.6.1; 4.1.6.1 in Version 2009);
- Recovery unit, which is recommended to be installed by the recyclable process, is modified (please refer to 5.1.6.2; 4.1.6.2 in Version 2009);
- The stipulations of devices that waste-water treatment equipment shall be

Technical Specification for Process of Anodizing and Electrophoretic Painting on Aluminum Alloy Extruded Profiles for Architecture

1 Scope

This Standard stipulates the terms, definitions, typical process flow chart, equipment requirements, quality requirement of mill finish profiles, manufacturing process requirements, process parameter control and product quality control of the technical specification for process of anodizing and electrophoretic painting on aluminum alloy extruded profiles for architecture.

This Standard is applicable to the manufacturing process for the processing of anodizing or anodizing electrophoretic painting (water-soluble varnish or colored painting) on the surface of aluminum alloy extruded profiles for architecture.

2 Normative References

The following documents are indispensable to the application of this document. In terms of references with a specific date, only versions with a specific date are applicable to this document. In terms of references without a specific date, the latest versions (including all the modification lists) are applicable to this document.

GB/T 4957 Non-conductive Coatings on Non-magnetic Basis Metals - Measurement of Coating Thickness - Eddy Current

GB/T 5237.1 Wrought Aluminum Alloy Extruded Profiles for Architecture - Part 1: Mill Finish Profiles

GB/T 5237.2 Wrought Aluminum Alloy Extruded Profiles for Architecture - Part 2: Anodized Colored Profiles

GB/T 5237.3 Wrought Aluminum Alloy Extruded Profiles for Architecture - Part 3: Electrophoretic Coating Profiles

GB/T 8005.3 Aluminum and Aluminum Alloys - Terms and Definitions - Part 3: Surface Treatment

GB/T 9286 Paints and Varnishes - Cross Cut Test for Films

electric current density and temperature) are satisfied.

5.1.2 Cooling equipment of anodizing electrolyte

Cooling equipment shall be able to absorb the heat generated during the electrolytic process and guarantee that the requirements of process temperature are satisfied. Under the circumstance of normal manufacturing, the equipment's cooling capacity should reach the requirement in Formula (1):

$$K = 0.0036 \times I \times (V + 3) \dots\dots\dots(1)$$

Where,

K---cooling capacity, expressed in (J/h);

I---maximum current, expressed in (A);

V---maximum voltage, expressed in (V).

5.1.3 Agitation equipment of anodizing electrolyte

Anodizing electrolyte shall be properly agitated, so as to reach the effect of heat dissipation, and guarantee that the temperature of the electrolyte maintains uniformly stable. Generally speaking, the mode of agitation shall adopt Roots blower air agitation, circulating pump agitation, or a combination of Roots blower air agitation and circulating pump agitation. When air agitation is adopted, the air for agitation shall contain no grease; the amount of air agitation for each square meter of electrolyte surface area shall be not less than 5 m³/h, and preferably 12 m³/h. When circulating pump agitation is adopted, the circulating capability of the circulatory system shall be 2.5 ~ 4.0 times of the volume of the electrolyte per hour.

5.1.4 Heating equipment

In order to guarantee that the tank solution's manufacturing temperature reaches the process requirements, heating equipment shall be installed on processing tank which needs to be heated. In addition, the heating capability of the heating equipment is requested to guarantee that the tank solution's temperature is controlled within the range of the process requirements.

5.1.5 Power supply equipment

5.1.5.1 Power supply equipment shall satisfy the manufacturing requirements. Power supply equipment shall install corresponding voltmeter and ampere meter. The minimum scale of the voltmeter shall be not more than 2% of the nominal value; the minimum scale of the ampere meter shall be not more than 5% of the nominal value. Furthermore, the voltmeter and ampere meter need to be validated and calibrated in accordance with the stipulated cycle of validation and calibration; the level of accuracy shall reach Level-1.5.

5.1.8.1 Curing oven shall install temperature controller. The temperature controller shall be able to directly display temperature data inside the oven. The heating zone of the curing oven shall install an overtemperature alarming system.

5.1.8.2 Under normal operation, the temperature difference of the curing oven should not be higher than 20 °C.

5.1.8.3 Curing oven's operating temperature range shall satisfy the requirement of painting curing temperature.

5.1.9 Conductive cathode plate

5.1.9.1 Conductive cathode plate shall select suitable materials. For instance, anodizing cathode plate may select pure aluminum plate; electrolytic coloring cathode plate may select pure nickel plate or stainless-steel plate; electrophoretic cathode plate may select stainless-steel plate.

5.1.9.2 The surface area of the conductive cathode plate shall match with the designed and processed profile area, and the rated processing capacity of the rectifier.

5.1.9.3 The conductive cathode plate shall be reasonably arranged, so as to guarantee that electric current is uniformly distributed.

5.1.9.4 Anodizing and electrophoretic cathode plate shall be equipped with an electrode cover.

5.1.10 Workshop air cleaning unit

In zones of pretreatment process, anodizing treatment process, electrophoretic painting process and curing process, air ventilation and purification facilities shall be installed, so as to guarantee the internal environment in the workshop and avoid contamination of air.

5.2 Inspection Equipment

In accordance with different inspection items, inspection equipment shall be divided into instruments and equipment for daily inspection, and instruments and equipment for periodical inspection. Please refer to Table 1 for details.

Table 1 -- Instruments and Equipment for Daily Inspection; Instruments and Equipment for Periodical Inspection

Classification of Instruments and Equipment	Inspection Items	Analytical Instruments and Inspection Equipment	Remarks
Instruments and Equipment for Daily	Tank Solution Analysis	Analytical balance, constant-temperature drying oven, acid	The division value of analytical balance is 0.0001 g.

	Curing Oven Temperature Curve	Oven temperature tracker	1. The measurement range of oven temperature tracker shall be more than the range of coating curing temperature; 2. Generally speaking, oven temperature tracker needs at least 4 temperature measurement lines: 1 of them measures air temperature; the other 3 lines measure the actual temperature of profile in 3 parts inside the oven: the top, the middle and the bottom.
--	-------------------------------	--------------------------	---

6 Quality Requirement of Mill Finish Profiles

The quality of mill finish profiles shall comply with the stipulations in GB/T 5237.1.

7 Manufacturing Process Requirements

7.1 General Requirements

7.1.1 When loading mill finish profiles, there shall be an appropriate spacing among the mill finish profiles, so as to guarantee that the anodizing oxide film is homogeneous.

7.1.2 When loading mill finish profiles in horizontal production lines, there shall be a certain inclination, which should be controlled at around 5°.

7.1.3 After each processing (pretreatment, anodizing treatment, coloring processing, hole-sealing processing and electrophoretic painting processing), water rinsing shall be conducted at least once. Some processing steps shall receive several times of water rinsing, for example, after alkali rinsing, anodizing treatment and electrolytic coloring treatment, water rinsing shall be conducted at least twice. Some water rinsing processes shall adopt deionized water. For example, before electrophoretic painting, deionized water, whose conductivity measured at 20 °C is less than, or equals to 30 μs/cm, should be adopted for rinsing. When condition allows, water in the water rinsing tank shall be filtered.

7.1.4 Cyclic utilization of water in the water rinsing tank should be taken into consideration.

7.1.5 Before anodizing treatment, the retention time of profiles, which have finished pretreatment, in the water rinsing tank should not be more than 30 min.

7.1.6 After anodizing treatment is finished, the profiles shall be placed into the water rinsing tank for water rinsing in time. After water rinsing is finished, the profiles shall be

					1.0
23	Water Rinsing 1	0.5 min ~ 3 min	Deionized water	Room temperature	–
24	Water Rinsing 2	0.5 min ~ 3 min	Deionized water	Room temperature	–
25	Drip-dry	Determine in accordance with electrophoretic painting suppliers' requirements			
26	Curing	Determine in accordance with electrophoretic painting suppliers' requirements			

7.2 Anodizing Pretreatment

7.2.1 Degreasing

7.2.1.1 Before anodizing treatment, degreasing treatment shall be conducted. The objective of degreasing is to eliminate grease on the surface of aluminum, so as to guarantee uniform effect on the surface of the profiles after alkali rinsing; reduce greasy dirt's contamination of the alkali rinsing tank solution. Thus, the quality of anodizing will be enhanced.

7.2.1.2 Degreasing treatment may select appropriate degreasing agent (for example, sulfuric acid solution).

7.2.1.3 Degreasing treatment may adopt the method of spraying or impregnation.

7.2.1.4 The concentration of tank solution shall comply with the technical requirements provided by degreasing agent suppliers. Please refer to Table 2 for the typical process of degreasing treatment.

7.2.2 Alkali rinsing

7.2.2.1 The objective of alkali rinsing is to eliminate natural oxide film on the surface of aluminum and further eliminate greasy dirt. Alkali rinsing is a critical process which affects the surface quality before anodizing.

7.2.2.2 Please refer to Table 2 for the typical process of alkali rinsing treatment.

7.2.3 Ash-removal

7.2.3.1 The objective of ash-removal treatment is to eliminate black ash, which is residual on the surface of aluminum profiles after alkali rinsing.

7.2.3.2 Ash-removal solution shall adopt acid solution. Generally speaking, sulfuric acid solution or nitric acid-sulfuric acid mixed solution is adopted.

7.2.3.3 When ash-removal solution adopts bright dipping agent, it should not contain fluorine ion, hexavalent chromium ion or other detrimental heavy metal ions.

thickness of anodizing oxide film is in direct proportion to the anodizing time. In constant-current density anodizing, the anodizing time is simply used to control the thickness of anodizing oxide film. Therefore, the anodizing time shall be determined in accordance with the thickness of anodizing oxide film that needs to be manufactured.

7.4 Coloring

7.4.1 Coloring methods for aluminum anodizing include electrolytic coloring and dyeing. In terms of electrolytic coloring, the hole-sealing performance, corrosion resistance and weather resistance of anodizing oxide film will be relatively satisfying, and the cost of operation is relatively low. Thus, it has been extensively applied to the coloring process of anodizing oxide film of aluminum profiles for architecture. Although other coloring processes may also be adopted, the product quality shall comply with the stipulations in GB/T 5237.2 or GB/T 5237.3. Since different coloring processes are adopted, the coloring process parameters also differ. Certain process parameters, such as the composition of coloring tank solution, the temperature of tank solution and the coloring time shall be determined by the technical requirements provided by the suppliers. Please refer to Table 2 for the typical process of coloring treatment.

7.4.2 Electrolytic coloring treatment process should adopt mono-nickel salt coloring treatment process, which is equipped with nickel recovery unit.

7.5 Hole-sealing

7.5.1 General principles

7.5.1.1 Hole-sealing of multiple-hole anodizing oxide film is a critical process, which guarantees the corrosion resistance, weather resistance and abrasive resistance of aluminum profiles for architecture, so as to obtain enduring applicability. Commonly used hole-sealing treatment methods include: thermal hole-sealing, cold hole-sealing and medium-temperature hole-sealing. Please refer to Table 2 for the typical process of hole-sealing treatment.

7.5.1.2 Hole-sealing process should gradually develop from nickel-containing and fluorine-containing cold hole-sealing process or medium-temperature hole-sealing process into nickel-free and fluorine-free cold hole-sealing process or medium-temperature hole-sealing process; it may also develop into thermal hole-sealing process.

7.5.2 Thermal hole-sealing

Thermal hole-sealing of anodizing oxide film is mainly divided into two types, namely, boiling water hole-sealing and high-temperature water vapor hole-sealing. The hole-sealing principle is heat-water combined hole-sealing. Boiling water hole-sealing has extremely high requirement towards water quality. Under normal conditions, the allowable content of various impurities in the boiling water hole-sealing is shown in Table 3.

7.6 Electrophoretic Painting

7.6.1 General principles

Certain process parameters, such as tank solution solid fraction, pH value, electrophoretic temperature, electrical conductivity, electrophoretic voltage, electrophoretic time, interelectrode distance and cathode-anode area ratio (electrode ratio), shall be intensively controlled. These process parameters are closely related with electrophoretic painting equipment and electrophoretic coating. Manufacturers of electrophoretic painting profiles shall select suitable electrophoretic painting manufacturing process in accordance with the performance of electrophoretic painting equipment and the nature of electrophoretic coating. Please refer to Table 2 for the typical process of electrophoretic painting treatment.

7.6.2 Tank solution solid fraction

Tank solution solid fraction is one of the important process parameters in electrophoretic painting treatment. It is closely related with the quality of the electrophoretic coating. An excessively low solid fraction may lead to attenuated painting film, which will easily lead to pinholes. An excessively high solid fraction may lead to nonuniform thickness of painting film.

7.6.3 pH value

Electrophoretic solution's pH value is an important parameter of guaranteeing electrophoretic resin's water solubility, so as to obtain high-quality electrophoretic coating. An excessively low pH value will lead to poor water solubility of electrophoretic resin. An excessively high pH value will lead to aggravated electrolysis of water, which will separate out a lot of bubbles and lead to a decrease of electrophoretic permeability.

7.6.4 Electrophoretic temperature

During electrophoretic painting treatment, since direct voltage has been imposed onto the tank solution, which leads to a rising trend of the temperature of the tank solution. When the temperature of the tank solution is excessively high, the quality of the film will be affected.

7.6.5 Electrophoretic voltage

Electrophoretic voltage is determined by the molecular weight and structural characteristics of electrophoretic resin itself. When electrophoretic voltage is excessively low, the rate of film formation will be slow, and it would even be impossible to form the film. Electrophoretic voltage is related with certain factors, such as: solid fraction of tank solution, temperature, pH value, electrical conductivity, interelectrode distance and surface characteristics of profiles (such as: thickness of anodizing oxide film, existence of electrolytic coloring, color depth), etc. Therefore, electrophoretic voltage shall often be adjusted in the specific electrophoretic solution system in

This is an excerpt of the PDF (Some pages are marked off intentionally)

Full-copy PDF can be purchased from 1 of 3 websites:

1. <https://www.ChineseStandard.us>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Select your country (currency), for example: USA (USD); Germany (Euro).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Tax invoice can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with download links).

2. <https://www.ChineseStandard.net>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Add to cart. Only accept USD (other currencies - <https://www.ChineseStandard.us>).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with PDFs attached, invoice and download links).

3. <https://www.google.com/search?tbm=bks&q=ChineseStandard.net>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Google Books -- Select your currency.
- Processed by Google (delivery, tax invoice etc.). Delivered in 9 seconds by Google.
- Tips: Download an unprotected **True-PDF** (text-editable) from Google-Books:
 1. <https://play.google.com/books> → 2. Sign in → Google account
 3. Find the **BOOK** you bought → 4. Click "3-dots" → Export
 5. Save as "*.pdf" (Save True-PDF to your local computer for offline reading/printing)

Translated by: Field Test Asia Pte. Ltd. (Incorporated & taxed in Singapore. Tax ID: 201302277C)

Accountable person and shareholder: Wayne Zheng

About Us (Goodwill, Policies, Fair Trading...): <https://www.chinesestandard.net/AboutUs.aspx>

Contact: Wayne Zheng, Sales@ChineseStandard.net

Linkin: <https://www.linkedin.com/in/waynezhengwenrui/>

----- The End -----