Specifications for the QUALANOD Quality Label for Sulphuric Acid-Based Anodizing of Aluminium

Edition 01.07.2010

EFFECTIVE FROM 1 July 2010

This edition supersedes the previous edition (15.09.2004) and incorporates
Update Sheets Nos. 1 to 8
It may be supplemented with new update sheets.

All current update sheets are published on the Internet: www.qualanod.net

OFFICIAL VERSION PRINTED BY QUALANOD

Josef Schoppig
General Secretary

Mailing address:
QUALANOD, P.O. Box 1507, CH – 8027 Zurich
Domicile:
QUALANOD, c/o AC-Fiduciaire SA (certification body)
Tödistrasse 47, CH – 8002 Zurich

no SCESp 045

Phone: +41 (0)43 305 09 70/79
Fax: +41 (0)43 305 09 98
E-mail: info@qualanod.net
Internet: www.qualanod.net

Main changes compared with the 2004 edition

The following update sheets have been incorporated:

- Update Sheet No. 1 (revised Appendix VI – Assessement of New Products and Processes)
- Update Sheet No. 2 (new appendix VIII – Continuous Coil Anodizing)
- Update Sheet No. 3 (Light fastness)
- Update Sheet No. 4 (Solutions for sealing test)
- Update Sheet No 5 (Negative results of abrasion test)
- Update Sheet No 6 (Explicit definition of sealing processes requiring an approval)
- Update Sheet No 7 (Specification of etching practices)
- Update Sheet No 8 (Rules for the use of the logo by third parties)

CONTENTS

1. GENERAL INFORMATION 6

2. TEST METHODS AND REQUIREMENTS 8

2.1. Appearance and colour (according to EN 12373-1) 8

2.1.1 Visible defects 8

2.1.2 Surface texture 8

2.2. Thickness measurement 8

2.2.1 Non-destructive tests 9

2.2.2 Destructive tests 10

2.2.3 Referee test 10

2.3. Sealing and impregnation tests 10

2.3.1 Dye spot test according to EN 12373-4 10

2.3.2 Measurement of admittance according to EN 12373-5 10

2.3.3 Measurement of loss of mass after immersion in phosphoric acid/chromic acid solution with prior acid treatment according to EN 12373-7 (weight loss test) 11

2.4. Abrasion resistance test 11

2.4.1 Abrasion resistance test method according to Appendix IV 11

2.4.2 Referee test 11

2.5. Light fastness 11

2.6. Acetic acid salt spray resistance according to ISO 9227 11

2.7. Nitric acid immersion test 12

3. WORK SPECIFICATIONS 14

3.1. Contract with the customer 14

3.1.1 Material 14

3.1.2 Surface texture 14

3.1.3 Thickness classes 15

3.1.4 Colour 15

3.1.5 Cleaning and maintenance 15

3.1.6 Complaints 15

3.2. Equipment of anodizing plants 15

3.2.1 Tanks 15

3.2.2 Cooling of the electrolyte 16

3.2.3 Agitation of the electrolyte 16

3.2.4 Heating 16

3.2.5 Current supply 16

3.2.6 Jigs 17

3.3. Processes of anodizing plants 17

3.3.1 Process requirements 17

3.3.2 Rinsing 18

3.3.3 Etching 18

3.3.4 Anodizing 19

3.3.5 Sealing by hydrothermal treatment 20

3.3.6 Cold impregnation/Cold sealing (CI-CS) based on nickel fluoride 20

3.3.7 Medium temperature sealing 23

3.4. Laboratory and testing apparatus 23

3.4.1 Laboratory 24

3.4.2 Instruments for measuring thickness 24

3.4.3 Instruments and solutions for sealing tests 24

3.4.4 Apparatus for testing baths 24

3.4.5 Material for the abrasion resistance test 24

4. SPECIFICATIONS FOR IN-HOUSE CONTROL 26

4.1. Testing the etching baths 26

4.2. Testing the anodizing baths 26

4.3. Checking the bath temperature 26

4.4. Checking the pH of sealing baths 27

4.5. Sealing tests 27
4.5.1 Dye spot test 27
4.5.2 Admittance 27
4.5.3 Weight loss test 27
4.6. Thickness test 28
4.7. Abrasion resistance test (see section 2.4.1) 28
4.8. Production control 28
4.9. Reinforcement of in-house control 28
4.10. Marking and labelling 29

5. LICENSING OF ANODIZING PLANTS 32
5.1. Granting of a licence 32
5.1.1 Inspection of finished products (P) 32
5.1.1.1 Inspection of laboratory and testing apparatus 32
5.1.1.2 Sampling of parts 32
5.1.1.3 Visible defects 32
5.1.1.4 Thickness measurement 32
5.1.1.5 Non-destructive sealing test (dye spot or admittance test) 33
5.1.1.6 Destructive sealing test (weight loss test) 33
5.1.1.7 Abrasion resistance test 33
5.1.1.8 Inspection of in-house control 33
5.1.1.9 Inspection of register of complaints 33
5.1.2 Inspection of plant and equipment (I) 33
5.1.3 Final assessment for granting a licence 33
Diagram A : Procedure for obtaining the quality label 34
5.1.4 Contract with the General Licensee 34
5.2. Routine inspections of licensees 35
5.2.1 Special rules for inspections of finished products 35
5.2.1.1 Repetition if the weight loss is greater than 30.0 mg/dm^2 35
5.2.1.2 Exceptional measures (if a weight loss value is ≥ 45 mg/dm^2) 35
5.2.2 Plant inspection (I) 35
5.2.3 Assessment of routine inspections 35
Diagram B : Procedure for renewing the quality label 36
5.3. Inspected plant's right of appeal 36
5.4. Confidentiality of information 37
5.5. Deadlines for submission of inspection reports 37

APPENDICES 39
APPENDIX I – TERMINOLOGY (FOR INFORMATION) 39
APPENDIX II A – REGULATIONS FOR USE OF THE QUALANOD QUALITY LABEL FOR SULPHURIC ACID-BASED ANODIZING OF ALUMINIUM (REQUIREMENTS) 41
APPENDIX II B – USE OF THE QUALITY LABEL (REQUIREMENTS) 44
APPENDIX III – SAMPLE SUB-LICENCE AGREEMENT CONCERNING THE QUALANOD QUALITY LABEL (FOR INFORMATION) 45
APPENDIX IV – ABRASION TEST FOR ANODIC OXIDATION COATINGS (REQUIREMENTS) 47
APPENDIX V – CLEANING AND MAINTENANCE (FOR INFORMATION) 49
APPENDIX VI – ASSESSMENT OF NEW PRODUCTS AND PROCESSES (REQUIREMENTS) 50
APPENDIX VII – LIST OF RELEVANT STANDARDS 53
APPENDIX VIII – CONTINUOUS COIL ANODIZING (REQUIREMENTS) 55

Chapter 1

General Information

1. General Information

QUALANOD is a quality label organisation founded in 1974 by several national associations encompassing architectural anodizers in the European Anodizers Association (EURAS)* and in conjunction with the European Wrought Aluminium Association (EWAA)**. This organisation is committed to maintaining and promoting the quality of anodised aluminium and its alloys.

* ESTAL (European Surface Treatment on Aluminium) since 1994
** EAA (European Aluminium Association) since 1982

These Specifications, which are aligned with EN 12373 and related standards (see appendix VII), serve as the reference base for the QUALANOD quality label and shall be strictly observed by holders of the quality label. Special attention should be paid to the following points:

Obligations on the anodizers

The Regulations for the use of the QUALANOD quality label are given in Appendix II.

Holders of the QUALANOD quality label shall work according to the Specifications unless the anodizer and the customer agree in writing on other conditions. This exception only applies for non architectural applications but the anodizer shall, in any case, follow the EN 12373-1 Standard. In such a case, the parts concerned shall be clearly identified.

Obligations on the anodizers are given in sections 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 3.3.1, 3.4, 4 and for continuous coil anodizing Appendix VIII. The scope of inspections is given in Chapter 5.

Thickness class

The thickness class of the anodic coating should be specified by the customer. National standards, section 3.1.3 and the definition “significant surface” given in Appendix I of the Specifications serve as the criteria. Values such as 13 to 17 µm or 17 to 23 µm do conform neither to the Specifications nor to the European Standard.

Forming after anodizing

Deformation after anodizing can locally damage the oxide film and reduce its resistance at these points depending on the bending radius. The effect on aesthetics can be most noticeable in external applications and for coloured products.

Identification of parts inspected

The anodizer shall indicate to the QUALANOD inspector which goods have passed the internal inspections. Goods that are kept in stock, ready for dispatch or ready, packed shall be considered to have been checked in the internal inspections.

Subcontracting

If a holder of the quality label subcontracts the whole or part of a customer's order for quality-labelled products to another plant, the subcontractor shall also hold the quality label.

Chapter 2

Test Methods and Requirements

2. Test Methods and Requirements

The anodized aluminium products of an anodizer holding a QUALANOD licence shall conform to the requirements for visible defects, coating thickness, sealing quality, abrasion resistance and light fastness as described in sections 2.1, 2.2, 2.3, 2.4 and 2.5 respectively.

2.1. Appearance and colour (according to EN 12373-1)

This section specifies the requirements for visible defects and how appearance and colour shall be assessed.

2.1.1 Visible defects

Anodized articles shall be free from visible defects on the significant surface(s) when viewed from a distance to be agreed between the interested parties. In the absence of such an agreement, the following minimum distances shall apply: 5 m for external architectural applications; 3 m for internal architectural applications; 0.5 m for decorative applications. If requested by the customer, the position(s) and maximum size(s) of the contact mark(s) shall be agreed between the anodizer and the customer.

2.1.2 Surface texture

The comparative assessment of appearance should be carried out visually or, for production control purposes, by using an instrumental method if it is possible.

Anodized aluminium has the property of double reflection from the surfaces of the anodic film and the basis metal. Therefore, for a comparative visual assessment, samples or components shall be set in the same plane and viewed as near to normal as is practicable with the direction of working (eg the rolling, extrusion or machining direction) always the same. They shall be viewed from a minimum distance as specified in 2.1.1.

Where the products are going to be used under natural lighting conditions, unless otherwise agreed, samples or components shall be compared in diffuse daylight from a northerly aspect in the northern hemisphere. If the products are to be used in artificial light, this lighting shall be used for the comparison, and a diffuse source of illumination shall be placed above and behind the viewer.

For surface texture, instrumental measurement shall be performed in accordance with the requirements of EN 12373-11, -12, -13 or -14 depending on the finish of the product. It is important to be attentive to any dependence of measuring on sample orientation (working direction), and to set operating procedures accordingly. For example, specular gloss should be measured by placing the sample in contact with the instrument so that the plane of incidence and reflection is parallel to the working direction of the metal.

2.2. Thickness measurement

This section specifies how coating thickness shall be measured and the requirements for thickness classes.

2.2.1 Non-destructive tests

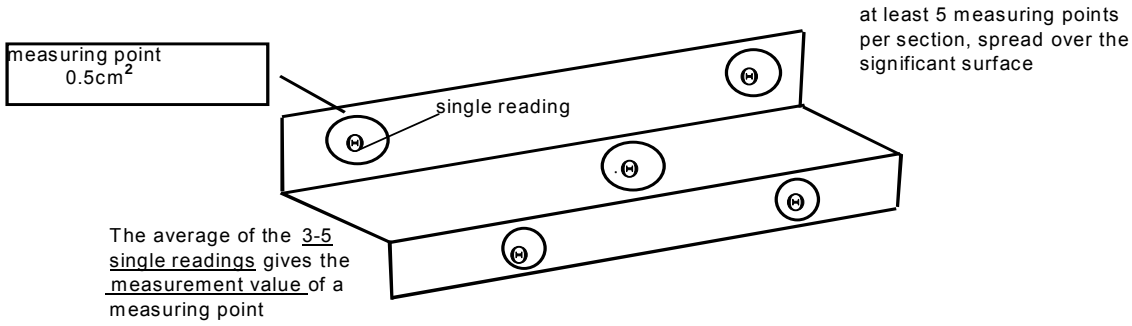
a) Eddy current test method according to EN ISO 2360

This is the usual method for measuring thickness. In case of dispute, the referee test shall be used (see section 2.2.3).

Procedure

The thickness of the film on each part to be tested shall be measured at not less than five measuring points (0.5 cm²), except if the size of the piece does not allow it, with 3 to 5 single readings taken at each point. The average of the single readings taken at one measuring point gives a measurement value (**local thickness**) which shall be recorded in the inspection reports.

For each part, the average of the five measurement values shall be calculated, giving the **component's average thickness**.



Requirements

The component's average thickness value expressed in micrometres shall be at least equal to the thickness class.

None of the local thicknesses, expressed in micrometres, may be less than 80% of the thickness class. Otherwise, the thickness test shall be considered as negative.

Assessment as shown by four examples with class 20

Example 1
Measurement in µm: 20, 22, 23, 21, 20 (average = 21.2)
This sample is perfect.

Example 2
Measurement in µm: 20, 23, 22, 22, 18 (average = 21.0)
This sample is good because the component's average thickness is over 20 µm and there is no measurement value below 16 µm: (80% of 20 µm).

Example 3
Measurement in µm: 18, 20, 19, 20, 18 (average = 19.0)
This sample is not satisfactory because the component's average thickness is below 20 µm and would be considered substandard under the last column of the table 5.1.1.3.

Example 4
Measurement in µm: 20, 24, 22, 22, 15 (average = 20.6)
This sample is not satisfactory even though the component's average thickness is over 20 µm because the measurement value of 15 µm is below the tolerance limit of 80% (16 µm). In such a case, an inspection would be unsatisfactory.

b) Split-beam optical method according to EN 12373-3

2.2.2 Destructive tests

a) Micro-section method according to EN ISO 1463

b) Gravimetric method according to EN 12373-2

2.2.3 Referee test

The micro-section method (EN ISO 1463) shall be used as the referee test.

2.3. Sealing and impregnation tests

This section specifies the tests that shall be used to assess sealing quality and the associated criteria for acceptable performance.

In cases where additives designed to prevent smutting are used in the sealing baths, special care should be exercised and greater attention paid to the referee test and the weight loss results and, where appropriate, the dye spot test.

2.3.1 Dye spot test according to EN 12373-4

The values 0 to 2 (on EN 12373-4 scale) shall be deemed acceptable. The values 3 to 5 shall be deemed unacceptable.

This test shall always be carried out on the part with the thickest film.

This test is less sensitive to hydrothermal sealing carried out with nickel and/or cobalt salts or detergent type organic additives. It is not suitable for coloured aluminium.

2.3.2 Measurement of admittance according to EN 12373-5

This test is not suitable for alloys containing more than 2% of silicon, 1.5% of manganese or 3% of magnesium nor for impregnated (cold sealed) parts.

The limit, expressed in µS, for colourless anodizing, for **integral colour anodized** and electrolytically coloured parts shall be:

$$\frac{400}{e} \quad (e = \text{film thickness in } \mu m)$$

This does not apply to electrolytically coloured parts in medium bronze, dark bronze and black for which a non-destructive test method does not yet exist. As a provisional solution, the hydrothermal sealing on such coloured sections shall be tested as follows:

The inspector shall first measure the admittance of the relevant lot. Then the referee test shall be carried out to section 2.3.3 on the section showing the highest

admittance value. If the result of the referee test is satisfactory, then the lot shall be passed; if not, the result of inspection shall be regarded as unsatisfactory.

2.3.3 Measurement of loss of mass after immersion in phosphoric acid/chromic acid solution with prior acid treatment according to EN 12373-7 (weight loss test)

This test is the **referee test** to evaluate sealing quality.

The maximum permissible loss of mass shall be **30.0 mg/dm²**.

When a lot is to be inspected, the weight loss test shall always be performed on the part with the highest admittance or, if cold impregnation is used, on the part with the highest thickness value.

2.4. Abrasion resistance test

This section specifies the tests that shall be used to assess abrasion resistance and the associated criteria for acceptable performance.

2.4.1 Abrasion resistance test method according to Appendix IV

This test is based on BS 6161, Part 18 : 1991.

Suitable glass coated paper, grade 00 very fine, for abrasion testing shall be available.

A dense deposit of chalky white powder indicates that the coating is softer than the abrasive and the component shall be rejected.

2.4.2 Referee test

In cases of dispute, samples shall be tested using the Abrasive Wheel Test Method (EN 12373-9). Samples having a Wear Index of less than 1.4 shall be deemed satisfactory.

2.5. Light fastness

ISO 2135
For external applications, the value shall reach or exceed a light fastness number of 8 as defined by ISO 2135.

Note that it has been demonstrated that electrolytically coloured anodised aluminium complies with this specification.

2.6. Acetic acid salt spray resistance according to ISO 9227

ISO 9227 (testing time: 1000 hours)
This test is used to assess products and processes which are not yet included in the Specifications (see Appendix VI).

2.7. Nitric acid immersion test

Measuring the weight loss after immersion in nitric acid (24 hours in 50% (vol) nitric acid at 20°C).

This test is used to assess products and processes which are not yet included in the Specifications (see Appendix VI).

Chapter 3

Work Specifications

3. Work Specifications

3.1. Contract with the customer

The contract between the anodizer and his customer shall specify:

- material;
- surface texture;
- thickness class;
- colour;
- cleaning and maintenance

3.1.1 Material

The QUALANOD Specifications apply to the aluminium and its alloys. The most commonly used alloys for anodizing are: 1000, 3000 and 5000 series for rolled products, and 6000 series for extruded products. These materials do not have the same appearance after anodizing even sometimes for the same alloy. This is why the customer should specify the alloy and attest that it conforms to the relevant standard and is suitable for anodizing that satisfies the requirements of the quality label.

Other alloys may be used by mutual agreement between the anodizer and customer who should specify in writing the anodizing thickness class and sealing required.

Appropriate special alloys can be used for integral colour anodizing processes.

“Anodizing quality”

To produce particularly decorative effects or a particularly uniform appearance, alloys of anodizing quality should be used. These are produced by special manufacturing techniques.

Metal for high-lustre surfaces

Higher purity aluminium should be used to produce a high-lustre surface.

"Self-colouring" alloys for the sulphuric or sulphuric-oxalic process

Other special alloys may be used to produce certain colours.

3.1.2 Surface texture

The appearance of the final products depends on the surface treatment immediately prior to anodizing and that appearance and the surface preparation designation system (EN 12373-1) and the reference standard shall be agreed between the customer and the anodizer. The requirements for uniformity of appearance relate to the permissible variations in the alloy including variations caused by the manufacturing process and to variations in the treatment by the anodizer.

The extent of admissible variations in the final appearance and uniformity should be agreed by means of indicative samples that have the required coating thickness and are acceptable to both parties. Also, the method of assessment should be agreed by both parties. It should be noted that it is not possible to specify “upper” and “lower” limits on appearance because a number of different factors contribute. For example,

although specular gloss varies on a scale up to 100, it is possible for samples with similar gloss values to look quite different under visual assessment.

3.1.3 Thickness classes

Anodic coatings are classified by a figure representing the thickness in micrometres on the significant surface.

There are the following thickness classes:

Class 5	minimum average thickness value	5 μm
Class 10	minimum average thickness value	10 μm
Class 15	minimum average thickness value	15 μm
Class 20	minimum average thickness value	20 μm
Class 25	minimum average thickness value	25 μm

The thickness class should be specified by the customer. For architectural applications, it depends on the national standards and on the aggressive nature of the environment according to:

internal applications	at least class 5
external applications	at least class 15

3.1.4 Colour

The colour of colour-anodized aluminium products shall be agreed between the customer and the anodizer. The permissible colour variation should be specified by means of samples that are acceptable to both parties. The samples may represent agreed darkest and lightest limits. Also, the method of assessment should be agreed by both parties.

3.1.5 Cleaning and maintenance

A simple maintenance programme based on a realistic appraisal of local conditions ensures a maximum useful life for anodized structural components at reasonable cost.

A detailed description is given in Appendix V.

3.1.6 Complaints

Any complaints by customers to anodizers should be made in writing. The anodizer shall maintain a register of complaints which includes actions taken (see 5.1.1.8).

3.2. Equipment of anodizing plants

This section includes requirements for the anodizing plants of licence holders.

3.2.1 Tanks

Material and lining

The material and/or lining of the tanks shall be chosen in order to avoid any risk of contamination of the solutions.

Capacity and design of the tanks

The volume of the anodizing baths shall be in proportion to the amperage to ensure that the required current density can be achieved and the specified temperature maintained.

3.2.2 Cooling of the electrolyte

Cooling capacity

The cooling capacity of the system used shall be capable of absorbing all the heat generated during the electrolytic process at maximum utilization of the electrical capacity installed, and at the rate it is generated. The heat generated in calories per hour by normal anodizing at the working temperature is approximately:

0.86 x I x (V + 3) = K where: I = maximum current in amperes
V = maximum voltage in volts
K = cooling capacity in kcal/h

Ambient conditions shall be taken into consideration when calculating the total cooling capacity.

3.2.3 Agitation of the electrolyte

Electrolyte movement relative to the workpieces shall be sufficient to remove the heat generated at the surface of the aluminium during the anodizing process.

Air agitation is extremely important for batch processing. It is a vital factor in maintaining the electrolyte temperature around the work piece and any areas with insufficient agitation can lead to poor anodic film quality in these areas. A minimum of 5 m^3/h per square metre of bath surface should be used (measured with a rotameter); the recommended value is 12 m^3/h per square metre of bath surface.

The air flow should ensure that the electrolyte is evenly agitated over the whole surface of the bath; this is best achieved using a large volume of low pressure air from a blower rather than a compressor. If a compressor is used, the dimensions of the pipes and agitation holes should be adjusted to give even agitation.

For batch processing, agitation of the electrolyte by conventional pump-recirculation is not sufficient to maintain proper temperature control in the bath.

3.2.4 Heating

Heating capacity

The heating capacity of the individual baths shall be related to the temperatures to be maintained during the various stages of treatment. In particular, it shall be possible to maintain the temperature of the hydrothermal sealing baths at a minimum of 96°C during the sealing process.

3.2.5 Current supply

The electric equipment and installations (rectifiers and busbars) shall be capable of generating the required current density for a load at the maximum installed rectifier capacity.

Voltage regulation

It shall be possible to regulate the DC supply in steps of no more than 0.5 volts.

The rate at which the voltage is applied is not critical. However, a slow reduction in voltage at the end of the cycle allows the anodic oxide film to be attacked.

Measuring instruments

The scales on voltmeters and ammeters shall be such that each division represents a maximum of 2% (volts) and 5% (amperes) of the total scale deflection.

The measuring instruments shall be in the precision class 1.5%, and shall be checked twice a year.

When using current supplies with complicated frequency waveforms, care shall be taken to ensure that the current-measuring instrument measures the true main current. It is very important to work with the correct current density and this means that the actual current supplied to the tank shall be measured.

Contacts

The voltage drop across the busbar to flightbar contact shall not be more than 0.3 volts; the temperature shall not rise to more than 30°C above the ambient temperature.

3.2.6 Jigs

Cross section of jigs

Aluminium supporting jigs submerged in the electrolyte shall have a cross section representing more than 0.2 mm²/amp. Larger sections are required for titanium which has higher resistance.

Contacts

The number and size of the contacts shall be sufficient to conduct the current evenly to all parts in the load and over the whole surface of each part. Pressure on the contacts shall be sufficiently high to prevent oxidation of the points of contact and any movement of the parts during electrolysis.

Jigging arrangement

The workpieces should be arranged on the jigs in such a way as to minimize anodic film thickness variation. Workpieces jigged very densely or multiple rows of workpieces without intermediate cathodes can lead to increased film thickness variation. Systems with central cathodes between the rows of workpieces are recommended.

3.3. Processes of anodizing plants

This section mainly comprises recommendations for licence holders on how to operate their anodizing plants. However, there are some requirements (see section 3.3.1).

3.3.1 Process requirements

Sealing processes applying any principle other than hydrothermal sealing or cold impregnation shall not be used unless they have been tested as stipulated in Appendix VI and approved by QUALANOD.

The instructions from suppliers of dyes, electrolytic colouring processes and approved medium temperature sealing processes shall be followed. The dye supplier's

instructions on the temperature and pH value of the dye bath and time of immersion shall be followed depending on the dye employed. Similarly, for electrolytic colouring, anodizers shall follow the practices recommended by the supplier. Medium temperature sealing systems shall be used in accordance with the suppliers' written instructions approved by QUALANOD.

When colouring parts, anodizers shall use dyes that satisfy the light fastness requirements of section 2.5. For external applications, the quality label may not be used for black electrolytic colouring using copper salts.

Where an additive is used in hot water sealing, the additive used and its application shall be recorded in writing and submitted to the inspector so that he can verify that it is used correctly.

Before and after anodizing, the aluminium products should be stored away from the anodizing facilities. After anodizing, they shall be protected from condensation and dirt. Every anodized part in stock shall be marked with the thickness class.

3.3.2 Rinsing

At least one separate rinse should be performed after each stage of treatment (surface preparation, anodizing, colouring).

Some stages of treatment require several rinses. This is particularly true of anodizing. As the first rinse is usually very acidic a second rinse is necessary before colouring or sealing.

Anodized workpieces should never be left for more than 1 to 2 minutes in the acid rinse. Workpieces left in an acid rinse for some time show signs of film attack.

3.3.3 Etching

The etching process and the aluminium metallurgy are important in producing the appearance required of the anodized product. Consequently, to be able to achieve a high level of consistency and uniformity, it is important to properly control the etching process.

The anodizer should follow closely the instructions from the supplier of the etch chemicals and, where available, the supplier of the semi-fabricated product. In the absence of full instructions, the anodizer should take particular measures indicated below.

In order to achieve a consistent product, it is necessary to control within tight tolerances the concentrations of free sodium hydroxide, aluminium and any sequestrant, and the solution temperature. Solution composition can be effectively controlled by using a crystallizer to continuously regenerate the solution or by using a "long-life" etch where the masses of materials entering and leaving the etch solution are balanced.

Whereas during etching, aluminium loses mass at a constant rate, the gloss falls at a decreasing rate. After a certain time depending on the etching conditions, an approximately constant gloss level is achieved. Anodizers should identify this regime for their particular etch conditions and set the processing time accordingly. This makes the process very much more controllable and reduces product inconsistency that might arise from poor reproducibility of etching time, excessive drainage time after the load has been withdrawn from the etch tank and excessive rinsing at relatively high pH values.

3.3.4 Anodizing

This section indicates typical batch anodizing conditions with hydrothermal sealing or impregnation (cold sealing). Other electrolytes and/or other conditions may be used provided that the anodizing quality is at least as good as the quality produced by anodizing according to the Specifications.

Sulphuric acid electrolytes

The concentration of free H_2SO_4 should be not more than 200 g/l, variable within ± 10 g/l of the selected value.

The aluminium content should be not more than 20 g/l but preferably within 5 to 15 g/l.

The chloride content should be not more than 100 mg/l.

The acid concentration is only critical at high anodizing temperatures. High acid concentrations lower the anodizing voltage required (about 0.04 V per g/l of H_2SO_4), but also lead to greater drag-out and higher acid consumption. Low aluminium contents increase the sensitivity of the film to high bath temperatures. The higher the aluminium content, the higher the anodizing voltage required (about 0.2 V per g/l of aluminium). Chloride in the anodizing electrolyte can cause pitting during anodizing and has been found to adversely affect resistance to weathering.

Sulphuric acid - oxalic acid electrolytes

The concentration of free H_2SO_4 should be not more than 200 g/l, variable within ± 10 g/l of the selected value.

The concentration of oxalic acid should be at least 7 g/l. There is no advantage or disadvantage above 10 g/l. 5 g/l of oxalic acid is too low to have an effect and increasing the level improves the film quality. Oxalic acid concentrations of over 15 g/l have no advantage and increase the production costs.

The aluminium content should be not more than 20 g/l but preferably within 5 to 15 g/l.

Temperature of sulphuric acid bath

This should be controllable within ± 1.5°C of the selected temperature regardless of the size of the load. The maximum acceptable temperature difference in the bath in the vicinity of the workpieces shoud be 2°C and within the maximum range prescribed.

Thickness classes	actual bath temperature
5 and 10	not above 21°C
15, 20 and 25	not above 20°C

These temperatures represent the maximum temperature at any time and anywhere in the electrolytic bath during the process. The anodizing electrolyte temperature is the single most critical factor affecting anodic film quality and excessive temperatures caused by poor control, poor agitation or poor jigging are responsible for most anodizing quality problems.

Temperature of sulphuric acid-oxalic acid bath

This should be controllable within ± 1.5°C of the selected temperature regardless of the size of the load. The maximum acceptable temperature difference in the bath in the vicinity of the workpieces shoud be 2°C and within the maximum range prescribed.

For all thickness classes the bath temperature should not be above 24°C.

This temperature represents the maximum temperature at any time and anywhere in the electrolytic bath during the process.

Current density

For sulphuric acid-based anodizing, the average current density should be:

1.2 – 2.0 amp/dm² for class 5, 10
1.4 – 2.0 amp/dm² for class 15
1.5 – 2.0 amp/dm² for class 20, 25

A risky factor for quality is the use of low current densities to produce thick films (classes 20 and 25). High current densities require good contacts and good agitation but are less likely to give quality problems.

Anodizing electrodes (cathodes)

The cathode to anode (working surface) ratio should be in the region of 1:1.5 to 1:2.5.

Aluminium cathodes are recommended. For cathodes on the side of the tank, only one side should be considered; for central cathodes, both sides should be considered.

Where there is a high cathode to anode ratio the use of lead lined tanks without shielding can lead to film thickness variation problems. Aluminium electrodes require the lowest operating voltages.

The distance between the cathode and the anode should not be less than 150 mm.

Transfer of the workpieces after anodizing

When the anodizing cycle has been completed, the workpieces should be transferred from the anodizing electrolyte to the rinse as quickly as possible. They should never be left in an anodizing bath without current. This is another factor that can cause film attack and deterioration in film quality particularly at the film surface.

3.3.5 Sealing by hydrothermal treatment

Sealing time

The time necessary to get a good sealing should be at least 2 minutes per micrometer unless there is a preseal.

Hot water sealing

The temperature should not be below 96°C 10 minutes after immersion of the load.

Phosphates, fluorides and silicates inhibit the sealing process.

Hot water sealing with bath additives

Where an additive is used in the sealing baths (for instance to prevent smutting), it will not be mandatory to follow the procedure described in Appendix VI but special care should be exercised and greater attention paid to the referee test.

Steam sealing

The minimum temperature should be the saturated steam temperature.

3.3.6 Cold impregnation/Cold sealing (CI-CS) based on nickel fluoride

This section makes recommendations for the implementation of impregnation or "cold sealing" processes based on nickel fluoride. It incorporates the knowledge about

these processes gained in the past years, and defines the most important parameters[1].

Anodizing conditions

As for other sealing processes it is essential to produce a good quality anodic oxide film adhering to the conditions stipulated in section 3.3.4.

First stage of treatment: impregnation

Concentration of the **CI-CS** product:

Nickel ion content	1.2 - 2.0 g/l
Free fluoride ions	0.5 - 0.8 g/l

Warning: Bath contaminants can inhibit the cold sealing process and their suggested limits are shown below:

sodium[2] or potassium[3] ions	less than	300 ppm
ammonium[4] ions	less than	1,500 ppm
sulphate ions	less than	4,000 ppm
phosphate ions	less than	5 ppm
aluminium ions	less than	250 ppm

The effect of bath contamination increases when there are several of these substances present and poor sealing quality can occur at even lower levels than those indicated.

Bath temperature	25 to 30°C
pH	6 ± 0.5
Impregnation time	0.8 to 1.2 min/µm of the anodic oxide film
Rinsing	Rinsing after impregnation is essential.

CI-CS products

The supplier should give the anodizer precise details of the percentage of active components and, if a powder, the percentage of insoluble matter in the products.

Insoluble matter in the product (e.g. dehydrated nickel fluoride) deposits on the surface of the anodized work in powder form and should always constitute less than 3% of the powder product. Continuous filtration of the CI-CS bath is necessary.

Preparation of the bath

The quality of the water is important for CI-CS processes. Impurities, such as calcium and aluminium, form insoluble products with the fluoride ions, lowering their concentration and sometimes forming powder deposits. It is essential to use demineralized water to make up the bath.

Agitation of the bath is generally necessary, and filtration is always essential to avoid turbidity.

[1] NOTE: Cold impregnation/cold sealing (CI-CS) processes are based on chemicals which diffuse into the pores of the anodic oxide film and initiate a chemical reaction. Therefore, a CI-CS process depends not only on the temperature but also on the chemicals used and other process factors. This specification relates only to CI-CS processes based on nickel fluoride.

[2] These substances are used to adjust the bath mixture.

[3] These substances are used to adjust the bath mixture.

[4] These substances are used to adjust the bath mixture.

Operating parameters

The operating parameters for CI-CS are critically important and should be closely controlled to achieve a satisfactory result. It is also important to remember that the parameters are interdependent; for example, a high fluoride ion concentration requires a lower operating temperature and/or a shorter sealing time and a higher pH. Additionally the molar ratio between nickel and fluoride is a very critical factor because their rates of consumption differ.

Bath concentration

The most important bath constituents to be tested are the nickel and fluoride contents. Excess free fluoride ions can attack the anodic coating, so the molar ratio between nickel and fluoride should not exceed 1:2. In practice, this means that the concentration of nickel should be greater than 1.55 times the free fluoride content.

The nickel ion and free fluoride contents should be maintained within the following levels:

Ni ion content	1.2 - 2.0 g/l
free fluoride ion content	0.5 - 0.8 g/l

In some cases, 5 - 10% of the nickel can be substituted by cobalt to minimize the greenish tint on uncoloured parts.

The free fluoride content of the bath and the nickel/fluoride ratio should be checked at least once a day and the bath replenished with extreme care, avoiding use of the bath until the substances added have been fully dispersed.

Nickel fluoride is not readily soluble so it can contain insoluble matter. It is advisable to make additions in a mixing chamber outside the bath. In addition, fluoride is consumed at a higher rate than nickel, and additions of ammonium fluoride or a dilute (10%) hydrofluoric acid solution[5] can be required to maintain the correct balance.

Measurement of the total fluoride content indicates the amount of fluoride bound in strong complexes or in slightly soluble compounds in suspension, and this gives important information about the level of contaminants in the bath. It has been found to be an asset to keep the free fluoride concentration at the lower limit if the difference between free ions and the total fluoride level is great.

Analytical methods for checking the baths should be provided by the producer of the product. Generally an EDTA method is used for nickel and a potentiometric method with an ion-sensitive electrode for free fluoride. Volumetric methods can be used for estimating the total fluoride level.

Bath temperature

The bath should be maintained at a temperature between 25°C and 30°C.

This parameter has a great influence on the kinetics of the process. Too high a temperature, particularly when the free fluoride concentration is at a high level, causes the anodic oxide film to be attacked and results in a powdery surface.

Bath pH

The pH of the solution should be maintained at 6 $\pm$ 0.5.

[5] Hydrofluoric acid solutions are very dangerous and must be handled with extreme care.

As a rule, the higher the pH the better, but it is not possible to go above 6.5 without causing precipitation of nickel hydroxide. The pH affects the amount of nickel precipitated in the pores, and below 5.5 insufficient nickel is deposited.

Warning: the pH should be measured with utmost care as fluoride in the solution can attack the pH electrodes or damage the glass membrane. This makes it very important to check the pH electrodes at regular intervals.

Impregnation time

The impregnation time should be between 0.8 and 1.2 min/µm of anodic film thickness.

Rinsing after CI-CS

Thorough rinsing in cold water is essential after CI-CS.

Second stage of treatment - ageing by hot water treatment

To complete the CI-CS process, the treated parts should be exposed to high humidity for some time, which can be accelerated by immersing the cold sealed parts in a hot water bath according to 3.2.11 for 0.8 to 1.2 min/µm or in a 5 to 10 g/l nickel sulphate solution at a minimum temperature of 60°C for 0.8 – 1.2 min/µm. This makes the work easier to handle and check, and should be considered an essential part of the treatment.

Thorough rinsing between cold impregnation and hot water treatment is absolutely essential as the fluoride ions would inhibit the hydrothermal sealing processes.

Cold impregnated films are more prone to crazing than conventionally sealed films, especially when exposed in warm, dry environments. This effect is greatly reduced by the treatment in hot water after cold sealing.

Quality control

If the CI-CS process is applied as described, including immersion in hot water after cold sealing, the sealed work can be tested in the same way as conventionally sealed work.

The most suitable tests are the dye spot test according to EN 12373-4 and the weight loss test according to EN 12373-7. The acceptance limits are those specified in sections 2.3.1 and 2.3.3.

At this stage, it is uncertain whether the admittance method according to EN 12373-5 can be applied to cold sealed parts.

3.3.7 Medium temperature sealing

Only systems tested and approved by QUALANOD as stipulated in Appendix VI may be used for the purposes of the quality label.

3.4. Laboratory and testing apparatus

This section includes requirements for the laboratory and testing apparatus of licence holders.

3.4.1 Laboratory

The anodizing plant shall have laboratory facilities. Each piece of apparatus shall have a data sheet showing the apparatus identification number and calibration checks.

3.4.2 Instruments for measuring thickness

The plants shall have at least two instruments for measuring thickness using the eddy current method or one instrument for the eddy current method and one split-beam optical microscope for measuring thickness according to sections 2.2.1 a) and b).

3.4.3 Instruments and solutions for sealing tests

The plant shall have at least one instrument for measuring admittance and a reference unit for checking the reading accuracy of the device.

Exception: If a plant uses cold impregnation only, this instrument is not necessary.

The plant shall have the following equipment to carry out the referee test stipulated in section 2.3.3:

- analytical balance (precision 0.1 mg)
- drying oven
- dessicator

The plant laboratory shall have solutions available to carry out the dye spot test.

Exception: If a plant uses the admittance test only, the solutions for the dye spot test are not necessary.

3.4.4 Apparatus for testing baths

The plant laboratory shall have a pH meter and two buffer solutions.

3.4.5 Material for the abrasion resistance test

Suitable glass coated paper, grade 00 very fine, for abrasion testing shall be available (see section 2.4.1).

Chapter 4

Specifications for In-House Control

4. Specifications for In-House Control

The purpose of in-house control is to make sure of the quality of the product following the Specifications. The licence holder shall comply with the requirements of this section. The same criteria shall be applied for coil anodizing but with the deviations of Appendix VIII. In the case of non conformity, the anodizer shall take immediate remedial action and test further the corresponding production before sending it to the customer. All these actions shall be registered.

4.1. Testing the etching baths

The etching baths shall be analysed in accordance with the instructions of the supplier of the etch chemicals. In the absence of such instructions, the analysis of total sodium hydroxide, aluminium and, if appropriate, the sequestrant shall be carried out at least:

- once a day per bath if three shifts are worked per day;
- once every two days per bath if two eight-hour shifts are worked per day;
- once every three days per bath if one eight-hour shift is worked per day;

and the bath shall be adjusted accordingly.

The results of these analyses shall be entered in charts or some other records readily accessible to the inspector. The following data shall be recorded: the actual values registered and the number of shifts worked.

4.2. Testing the anodizing baths

The anodizing baths shall be analysed at least:

- once a day per bath if three shifts are worked per day;
- once every two days per bath if two eight-hour shifts are worked per day;
- once every three days per bath if one eight-hour shift is worked per day.

The results of these analyses shall be entered in charts or some other records readily accessible to the inspector. The following data shall be recorded: ideal values, the maximum values that are not to be exceeded, the actual values registered and the number of shifts worked.

Important: It is stressed that the maximum permissible values specified in section 3.3.4 apply to typical anodizing conditions only. All different conditions accepted by QUALANOD shall be recorded in writing and these records shall be placed at the inspector's disposal so that he can verify that they were applied correctly.

4.3. Checking the bath temperature

The temperature of each etching, anodizing and sealing bath shall be checked at least twice in every work shift at regular intervals.

The temperature of the etching bath shall be measured at the beginning of the etching cycle.

The temperature of the anodizing bath shall be measured at the end of the anodizing cycle.

The temperature of the sealing bath shall be measured 10 minutes after immersion of the load.

The results of these tests shall be entered in charts or some other records readily accessible to the inspector.

4.4. Checking the pH of sealing baths

The pH value of the sealing baths shall be checked twice in every work shift, at regular intervals.

The results shall be entered in charts or some other records readily accessible to the inspector.

4.5. Sealing tests

4.5.1 Dye spot test

This test shall always be carried out on the part with the thickest film.

For natural or light-coloured anodized aluminium, the dye spot test shall be carried out at least once per bath in every work shift.

If the result of the dye spot test is 2, either a weight loss test shall be carried out or the sealing shall be repeated and then the dye spot test shall be performed. The results of any weight loss test and the results of the test shall be entered in the production control register (see section 4.8).

The chemical supplier's instructions to prepare the solutions shall be followed. If the colorant solutions described in the standard EN 12373-4 are stored properly, they will remain stable for up to two years. However, their pH values should be checked every 3 months. If the pH of a solution is outside the range prescribed by the chemical supplier, then it should be corrected following the chemical supplier's instructions.

4.5.2 Admittance

If the admittance is measured according to EN 12373-5 instead of carrying out the dye spot test, rules analogous to those in section 4.5.1 shall apply; i.e. either a weight loss test shall be carried out or the sealing shall be repeated if the measured value exceeds the limit value (20 µS).

4.5.3 Weight loss test

The weight loss test according to EN 12373-7 shall be carried out at least:

- once a day per sealing bath if colour anodized products represent 100% of total output in the week;
- once every two days per sealing bath if colour anodized products account for more than 50% and less than 100% of total output in the week;
- once a week per sealing bath if colour anodized products account for less than 50% of total output in the week.

Important: it must be noted that the sealing time shall be defined as a function of the maximum thickness that is actually measured and not as a function of the theoretical thickness requested by the customer.

If it is not possible to take samples from the production lot, the anodizer may carry out the weight loss test on sample panels made of the same alloy as the production lot and treated simultaneously with it. This shall be mentioned in the register.

4.6. Thickness test

The film thickness shall be tested at least once on the finished products from every flight bar. Film thickness checking before colouring and sealing is recommended.

The maximum and minimum values finally measured on the finished product shall be entered in the production control register (see section 4.8).

If it is not possible to take samples from the production lot, the anodizer may carry out the thickness test on sample panels made of the same alloy as the production lot and treated simultaneously with it. This shall be mentioned in the register.

4.7. Abrasion resistance test (see section 2.4.1)

An abrasion resistance test shall be carried out at least once per shift on parts from each anodizing tank for thickness classes 20 and 25.

If it is not possible to take samples from the production lot, the anodizer may carry out the abrasion test on sample panels made of the same alloy as the production lot and treated simultaneously with it. This shall be mentioned in the register.

4.8. Production control

The anodizer shall have a secure control system following the production and it shall show at least the information below:

- the customer's name and address, order or serial number;
- the production date;
- kind of anodizing, natural or coloured;
- the agreed film thickness class and the actual thickness measured, (minimum and maximum values);
- the results of the dye spot test or admittance measurement, as applicable;
- the results of the weight loss test;
- measures taken to remedy values not meeting the requirements;
- other remarks.

This information may be recorded on a computer system.

4.9. Reinforcement of in-house control

If the results of an inspection do not meet the requirements, whatever the reason for the negative result:

1) the company shall write a letter to the General Licensee giving explanations and proposing solutions;

2) the company shall reinforce in-house control by doubling the frequency of the bath tests for a period of six months:
   - Dye spot or admittance test: twice per shift and per bath
   - Weight loss test:
     - once every two days per bath if colouring < 50% of the weekly production
     - once every day per bath if colouring ≥ 50% and < 100%
     - once per shift and per bath if colouring = 100%

4.10. Marking and labelling

The anodizer shall specify and maintain procedures to associate the production clearly with the pertinent drawings, specifications or other documents during all phases of production, delivery and assembly. Individual products, lots or batches must be identified unmistakably. This identification shall be recorded in the in-house control register.

Goods, packaging and accompanying documents shall be marked and labelled according to the "Regulations for Use of the QUALANOD Quality Label" (App. II a, 7).

Specifications for in-house control in anodizing plants

Object tested	Minimum frequency	Results
Etching and anodizing baths	Once a day per bath if three shifts are worked per a day once every two days per bath if two eight-hour shifts are worked per day once every three days per bath if one eight-hour shift is worked per day	The results shall be entered in charts or some other records (2).
Temperature of the etching, anodizing and sealing baths	Twice per bath in every shift, at regular intervals to be measured: - at the beginning of the etching cycle (etching bath) - at the end of the anodizing cycle (anodizing bath) - ten minutes after immersion (sealing bath)	The results shall be entered in charts or some other records (2).
pH of the sealing baths	Twice in every shift, at regular intervals	The results shall be entered in charts or some other records (2).
Sealing	Dye spot test or admittance measurement for natural anodized aluminium: Once per bath in every shift Weight loss: - once a day per bath if colour anodized products account for 100% (1) - once every two days per bath if colour anodized products account for more than 50% (1) - once a week per bath if colour anodized products account for less than 50% (1)	If the result of the dye spot test is 2 or if the admittance value reaches the limit of 400/e µS/µm, the weight loss test shall be repeated or the parts shall be resealed. The test results shall be recorded in the production control register.
Film thickness	Once per flight bar on the finished product.	Results shall be recorded on the manufacturing tags and in production control register.
Thickness classes 20 or 25	Abrasion test at least once per shift from each anodizing tank	Light powder deposit on the abrasive paper.

1) of the total output in the week

2) readily accessible to the inspector

Reinforcement of in-house control: see section 4.9

Chapter 5

Licensing of Anodizing Plants

5. Licensing of Anodizing Plants

5.1. Granting of a licence

To obtain a QUALANOD licence, a plant shall go through the procedure set out in Diagram A.

5.1.1 Inspection of finished products (P)

All test results shall be in accordance with the requirements of the Specifications.

If it is not possible to take samples from the production lot because of the shape, size or form of the product, the inspector may carry out the tests on sample panels made of the same alloy as the production lot and treated simultaneously with it.

5.1.1.1 Inspection of laboratory and testing apparatus

The laboratory and testing apparatus shall be as specified in section 3.4 to ensure that the equipment is available and functional.

5.1.1.2 Sampling of parts

The tests on finished products shall only be made on parts which the plant has inspected and passed as satisfactory or parts which have been packed and/or are ready for dispatch. A welded frame shall be considered to be one test piece. Each part of a frame that has been mechanically screwed together shall comprise one test part. Constructions joined together by heat-insulating, nonconductive material shall be taken to comprise separate parts.

5.1.1.3 Visible defects

Finished products shall be free of visible defects as described in section 2.1.1.

5.1.1.4 Thickness measurement

Sheet and strip sections with a significant surface greater than 2 m²

All parts shall be checked completely and all parts shall have a sufficient film thickness.

Other parts: statistical control shall be applied using samples taken according to the table below:

Lot size (')	Number of samples selected randomly	Acceptable number of sub-standard samples
1 – 10	All	0
11 – 200	10	1
201 – 300	15	1
301 – 500	20	2
501 – 800	30	3
801 – 1,300	40	3
1,301 – 3,200	55	4
3,201 – 8,000	75	6
8,001 – 22,000	115	8
22,001 – 110,000	150	11

Lot = a customer's complete order or the part of it that is in the plant.

The inspector shall always check at least 30 parts.

No local thickness may be less than 80% of the required coating thickness class.

The number of components which may each have an average thickness below the minimum average thickness for the required thickness class is shown in the above table. Note that no measured component may have a local thickness less than 80% of the thickness class.

5.1.1.5 Non-destructive sealing test (dye spot or admittance test)

The sealing shall be tested using the dye spot or admittance test at the inspector's option.

The rules on sampling are the same as for thickness measurements except that all the samples shall satisfy the minimum requirements.

5.1.1.6 Destructive sealing test (weight loss test)

The two inspections for granting the quality label shall each include at least one weight loss test.

The inspector has the option of making the weight loss test in his laboratory on samples taken at the plant under inspection.

The samples shall be taken from sections that have already been tested and prepared by the anodizer as instructed by the inspector. The inspector shall mark the samples to prevent them from being exchanged.

5.1.1.7 Abrasion resistance test

If the samples taken according to section 5.1.1.2 include samples of thickness classes 20 or 25, the inspector shall perform the abrasion resistance test (section 2.4.1) on one of those samples.

If the result of the abrasion resistance test is negative, the referee test shall be applied automatically (see section 2.4.2). If the referee test is negative, the visit shall be considered unsatisfactory.

5.1.1.8 Inspection of in-house control

The inspector shall check whether the in-house control has been carried out and the results recorded fully as specified in Chapter 4.

5.1.1.9 Inspection of register of complaints

The inspector shall check whether a register of complaints has been maintained and adequately describes how complaints have been investigated and actions taken.

5.1.2 Inspection of plant and equipment (I)

As set out in sections 3.2 and 3.3.1.

5.1.3 Final assessment for granting a licence

The inspection results shall be recorded in an official inspection report provided by QUALANOD.

The inspector shall submit the inspection report to the General Licensee.

The inspection reports shall be assessed by the General Licensee. Under the supervision of QUALANOD, the General Licensee shall decide whether or not the plant has met the requirements.

If the results do not meet the requirements, the plant concerned shall be entitled to appeal to the General Licensee within 10 days.

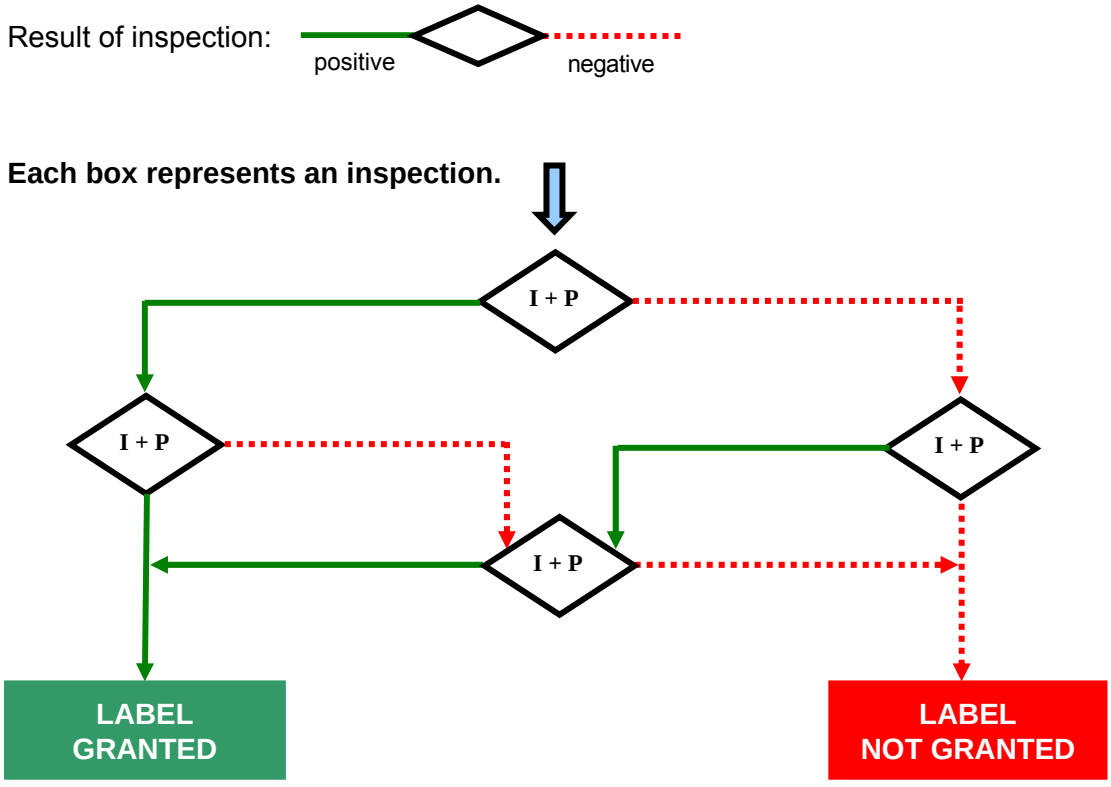
After an unsatisfactory inspection where plant and equipment have not met the requirements, another inspection may be made only when the company has given notification that it has rectified the deficiencies recorded.

For a licence to be granted, two inspections of plant, equipment and finished products shall be deemed satisfactory as set out in Diagram A below.

If a licence to use the quality label cannot be granted, the anodizer shall wait six months before making a new application for a licence.

Diagram A: Procedure for obtaining the quality label

P = Inspection of finished products (5.1.1)
I = Inspection of plant and equipment (5.1.2)



5.1.4 Contract with the General Licensee

When a licence has been granted, the sub-licensee and the General Licence holder shall sign a contract. The contract shall contain at least the requirements exhibited by the sample contract of Appendix III.

5.2. Routine inspections of licensees

To renew a licence, a plant shall go through the procedure set out in Diagram B below. Every licensee shall have a product inspection at least twice but no more than five times each year. Routine inspections shall be made without prior notice and shall include the same tests as for granting a licence except for the special rules below.

5.2.1 Special rules for inspections of finished products

5.2.1.1 Repetition if the weight loss is greater than 30.0 mg/dm²

If the inspector finds a weight loss greater than 30.0 mg/dm² during his inspection, he shall repeat the test with a new sample taken from the same part. This latter value shall be decisive for the inspection.

If it is greater than 30.0 mg/dm², the inspector shall check the company's plant and equipment as soon as possible.

5.2.1.2 Exceptional measures (if a weight loss value is ≥ 45 mg/dm²)

The inspector shall report immediately to the General Licensee.

Once the General Licensee has taken its decision (see 5.2.3), it shall inform QUALANOD before the company concerned is notified.

5.2.2 Plant inspection (I)

A plant inspection shall be made regularly every two years.

5.2.3 Assessment of routine inspections

The inspection results shall be recorded on an official information report form provided by QUALANOD.

The inspector shall submit the inspection report to the General Licensee.

The inspection reports shall be assessed by the General Licensee. Under the supervision of QUALANOD, the General Licensee shall decide whether or not the inspection has met the requirements and, if necessary, to withdraw the label in accordance with the procedure set out in Diagram B below. The company shall be notified of the decision in writing.

If the results do not meet the requirements, the plant concerned shall be entitled to appeal to the General Licensee within 10 days.

If the results do not meet the requirements because the inspector has found a weight loss test value equal to or greater than 45 mg/dm², the General Licensee, immediately informed by the inspector, shall decide within 2 weeks whether or not to withdraw the company's licence, basing its verdict on the results achieved by the company in previous years.

In addition to the normal repetition inspection to be carried out within one month if an inspection was unsatisfactory, an additional visit shall be made within four months to verify the reinforcement of in-house control according to section 4.9.

After an unsatisfactory inspection where plant and equipment have not met the requirements, another inspection may be made only when the company has given notification that it has rectified the deficiencies recorded.

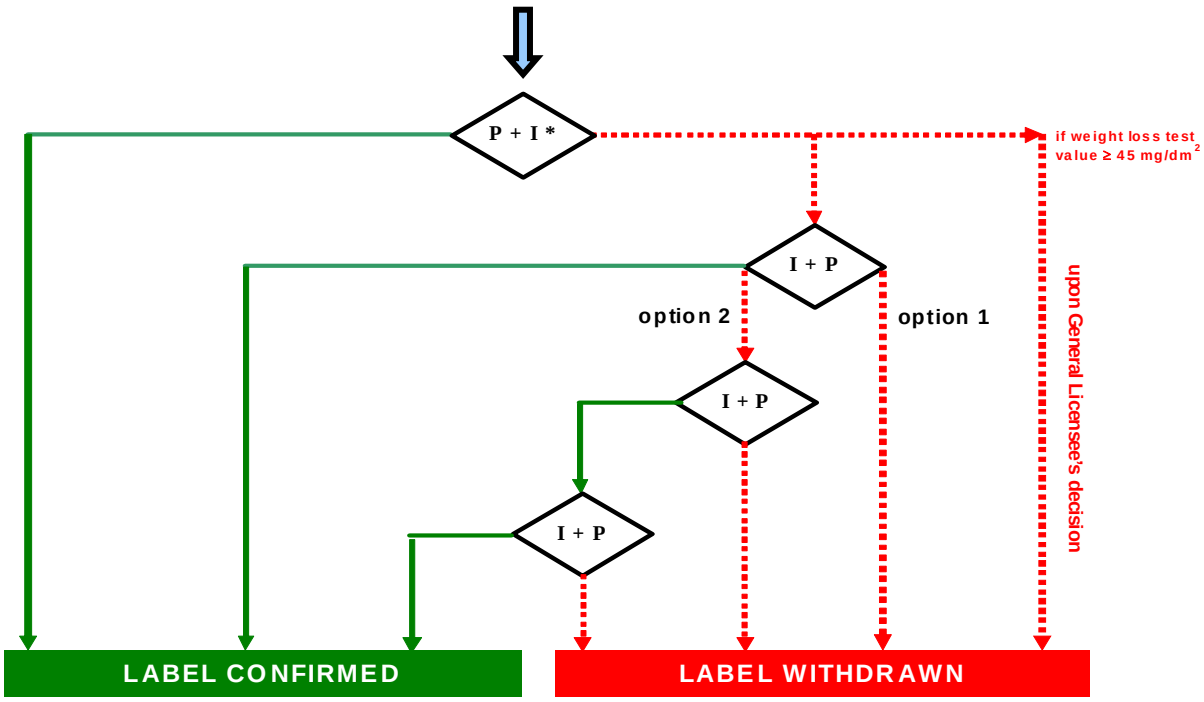
If a licence is withdrawn, the plant shall wait at least six months before making a new application for a licence to use the quality label.

Diagram B: Procedure for renewing the quality label

P = Inspection of finished products (5.1.1)
I = Inspection of plant and equipment (5.1.2)

Result of inspection: positive negative

Each box represents an inspection.



(*) plant inspection (I) at least every two years or whenever specified (see section 5.2.2)
Option 1 or 2 chosen by the anodizer
Option 2 may only be chosen once every five years

5.3. Inspected plant's right of appeal

The plant concerned shall receive a copy of each inspection report. If the results do not meet the requirements, full details and reasons shall be given. The plant shall be entitled to appeal within 10 days.

5.4. Confidentiality of information

All information concerning the inspection results and their assessment shall be confidential.

5.5. Deadlines for submission of inspection reports

Inspection reports that are negative shall be sent to QUALANOD's Secretariat by the General Licensees within one month after the inspection.

All other inspection reports shall reach QUALANOD's Secretariat within three months after the date of the inspection.

Appendices

Appendices

APPENDIX I – Terminology (for information)

ALUMINIUM *

Aluminium and aluminium-based alloys.

ANODIZED ALUMINIUM *

Aluminium with an anodic coating, produced by an electrolytic oxidation process in which the surface of the aluminium is converted to a mainly oxide coating having protective, decorative or functional properties.

ANODIZED WROUGHT ALUMINIUM FOR ARCHITECTURAL PURPOSES

Anodized wrought aluminium used for permanent structural components in indoor or outdoor applications where both appearance and durability are important.

AVERAGE THICKNESS *

Mean value of a specified number of local thickness measurements that are evenly distributed over the significant surface of a single anodized piece.

CLEAR ANODIZED ALUMINIUM *

Anodized aluminium with a substantially colourless, translucent anodic oxidation coating.

COLOUR ANODIZED ALUMINIUM *

Anodized aluminium coloured either during anodizing or by subsequent colouring processes.

COMBINATION COLOUR ANODIZED ALUMINIUM *

Anodized aluminium with an anodic oxidation coating that has been coloured by electrolytic colouring, or produced by integral colour anodizing, followed by absorption dyeing.

DECORATIVE ANODIZED ALUMINIUM

Anodized aluminium with a uniform or heterogeneous appearance which is aesthetically satisfying.

ELECTROLYTICALLY COLOURED ANODIZED ALUMINIUM *

Anodized aluminium with an anodic oxidation coating that has been coloured by the electrolytic deposition of a metal or metal oxide into the pore structure.

* Definitions identified by an asterisk are taken from EN 12373-1

HYDROTHERMAL SEALING OF ANODIZED ALUMINIUM

A sealing treatment after anodizing consisting of exposing the anodized aluminium to hot water not below 96°C or steam not below the saturated steam temperature.

IMPREGNATION OR SO-CALLED COLD SEALING OF ANODIZED ALUMINIUM

A sealing treatment after anodizing consisting of impregnation based on nickel fluoride followed by ageing in a hot water treatment.

INTEGRAL COLOUR ANODIZED ALUMINIUM *

Anodized aluminium that has been anodized using an appropriate (usually organic acid based) electrolyte which produces a coloured coating during the anodizing process itself.

INTERFERENCE COLOUR ANODIZED ALUMINIUM *

Anodized aluminium with an anodic oxidation coating coloured by means of optical interference effects.

LOCAL THICKNESS *

Mean of the thickness measurements of which a specified number is made within a reference area on the significant surface of a single article.

PRETREATMENT

Treatment changing the finish and quality of the aluminium surface by suitable mechanical, chemical or electrochemical processes before anodizing.

SEALING OF ANODIZED ALUMINIUM

Any process following anodizing which substantially reduces the porosity and adsorptive power of the anodic coating and simultaneously increases its chemical resistance.

SIGNIFICANT SURFACE

The significant surface must be specified by the customer. It is that part of the overall surface which is essential for the appearance or functionality of the part concerned.

* Definitions identified by an asterisk are taken from EN 12373-1

APPENDIX II a - Regulations for Use of the QUALANOD Quality Label for Sulphuric Acid-Based Anodizing of Aluminium (requirements)

1. Definition

Hereinafter "quality label" shall denote the above mark registered on October 2, 1974 with the Federal Office for Copyrights and Patents (Reg. nr. 272'069) and entered on October 21, 1974 in the International Trademarks Register nr. 409'951 by the Association for Quality Control in the Anodizing Industry (QUALANOD), Zurich. Renewed on September 16, 1994.

"QUALANOD" shall mean the Association for Quality Control in the Anodizing Industry, Zurich.

"GL" shall mean the General Licence Holder of a country.

"Licence" is a statement issued by or in the name of QUALANOD authorizing the use of the quality label according to the present regulations.

"Products covered by the licence" are those products listed under point 5 of the present regulations.

"Specifications" are the Specifications for a quality label for Sulphuric Acid-Based Anodizing of Aluminium.

“Sub-licence holder”, "Licence holder" or “holder” is the anodizer authorized to use the quality label.

2. Ownership of the quality label

The quality label is owned by QUALANOD and may not be adopted by anyone unless authorized to do so by a licence granted according to these regulations.

QUALANOD will grant GL a general licence for the quality label for the ..... (country) with powers to authorize use of the label according to the present regulations to individual anodizers.

3. Register of licence holders

QUALANOD shall keep a register which (in addition to other details which may be resolved upon now or later) shall show name, address and trade description of each licence holder, the date on which the licence was granted to the holder, the number assigned to each holder, the date of withdrawal of the licence and any other details which QUALANOD shall deem necessary.

The holder shall notify the GL without delay of any changes in name or address. The latter shall pass the information on to QUALANOD for the amendment of the appropriate entry in the register.

4. Qualifications of applicant

Authorization to use the quality label may be granted on condition that the applicant conducts, or intends to conduct an anodizing business which actually supplies products covered by the licence.

Grant of the licence entitles the holder to use the quality label for the products set out in the licence. The licence is not transferable.

5. Products covered by the licence

The quality label may only be used for sulphuric acid-based anodizing of aluminium which conforms to the Specifications.

6. Testing of the goods

According to Chapter 5 of the Specifications

7. Use of the quality label

7.1 Use of the logo by licence holders

The quality label may be used either in black and white or in blue and white on the goods themselves, on business stationery, quotations or invoices, price lists, cards display cards and on all company literature, brochures, catalogues and in newspaper advertisements. The words "Quality Label for Anodizing of Aluminium" (or some other text conforming with national legislation) may be added in the space to the right (see Appendix IIb, fig. 1 and fig. 2).

By the use of the label on a product the anodizer guarantees that the quality supplied complies with the quality offered or, as appropriate, the quality ordered.

The thickness class shall be

- printed in the symbol: when the quality label is stamped on goods and packaging
- given in writing: on invoices and accompanying papers referring to a particular consignment

If a licence holder has several anodizing plants, the quality label may only be used on the goods themselves and on packaging unless each plant belonging to the complex is entitled to use the quality label. This restriction does not apply if all branches of the complex are authorized to use the quality label.

The quality label, inner motif 25 x 25 mm, may be stamped or printed directly onto adhesive tape or stickers (see Appendix IIb, fig. 3) in the above-mentioned colours.

The holder may not make any alteration or addition to the quality label when using it. In the event of the separate use of the holder's own brand or trade marks on, or in connection with his products, these requirements may in no way be contravened. The holder shall, at all times, give the GL any information required with respect to his use of the quality label.

7.2 Use of the logo by third parties

Some businesses using anodised products may wish to use the logo on their finished products or business literature.

They shall request written authorisation which may be granted on condition that they:

- undertake to use solely aluminium products anodised by licensed anodising plants;
- undertake to submit all documents that refer to QUALANOD to the national associations for approval or directly to QUALANOD in countries where there is no national assoiation;
- undertake to undergo inspections and controls by the national associations or QUALANOD.

Such authorisation may require payment of an annual fee. Authorisation will be withdrawn automatically if any of the conditions set out above is not met.

8. Conditions for the grant, renewal or refusal of renewal of the licences

According to Chapter 5 of the Specifications

9. Withdrawal of licence

The GL shall withdraw the licence if the holder no longer complies with these regulations and in particular in the event of any unauthorized or incorrect use of the quality label. In the event of withdrawal of a licence, the holder shall receive written notification with immediate effect. In this case, or in the event of the holder ceasing to trade, all tags, labels, bands, stencils, stamps, sleeves, containers, price lists, business notices, business cards and any other objects in or on which the quality label is shown shall be either given in to the GL or, on the instructions of the latter, kept at the disposal of the GL until application for a new licence is made by the legal representatives or successors in business of the previous licence holder. The previous licence shall be deemed withdrawn until issue of the new licence. However, the legal representatives or successors in business of the previous licence holder shall be entitled to continue to use the quality label for three months pending the grant of a new licence unless the GL issues instructions to the contrary.

10. Amendments to the Regulations

These regulations may be amended from time to time. Such an amendment, however, can only influence the right of a holder to use the quality label if he has been given 4 months' prior notice in writing by the GL.

11. Communications

Any communication from or to the holder required to be made under these regulations shall be effective if made by a correctly stamped and addressed letter.

APPENDIX II b - Use of the Quality Label (requirements)



Fig. 1

May be used on stationery, company literature, catalogues etc. as well as on newspaper advertisements.



Fig. 2

The thickness class shall be included on the label if stamped on goods and packaging; also on invoices and accompanying papers referring to a particular consignment, unless the thickness class has already been indicated in these documents.



Fig. 3

May be stamped or printed directly on adhesive tapes or stickers in these two colours.

APPENDIX III - Sample Sub-Licence Agreement concerning the QUALANOD Quality Label (for information)

Between ..... (General Licence Holder, GL) domiciled in ..... as holder of the General Licence for the international label no. 409'951 registered on 21st October 1974, renewed on 16th September 1994 and authorized to utilize the label by issuing sub-licences and

..... in .....
(hereinafter the "sub-licensee")

The following agreement was reached today.

1. The sub-licensee states that he possesses copies of and is acquainted with the contents of the "Regulations for Use of the QUALANOD Quality Label" (Appendix IIa and IIb) and the "Specifications for the QUALANOD Quality Label for Sulphuric Acid-Based Anodizing of Aluminium". The sub-licensee hereby undertakes

   a) not to use the said label, either themselves or through their representatives, for products other than those falling under the licence according to paragraph 5 of the "Regulations";

   b) to permit the testing or examination of his products and/or to supply the samples necessary under Chapter 5 of the "Specifications";

   c) to comply with the "Regulations" and "Specifications" in every respect;

   d) in the event that production of the goods falling under the licence is discontinued the GL shall be informed at once;

   e) to report all changes of name or address promptly to the GL;

   f) to report immediately to the GL any contravention or any unauthorized or incorrect use of the label which comes to his notice and to cooperate with the GL and support them in preventing the misuse of this label;

   g) to pay the corresponding fees and costs (annual fee and inspection costs).

If investigation for reported misuse of the quality label confirms the allegation, the cost of the investigation shall be borne by the misuser. If the allegation proves unjustified then the cost shall be borne by the informer.

2. Following this statement by the sub-licensee which is hereby acknowledged the GL undertakes

   a) to issue a licence certificate to the sub-licensee entitling the latter to use the label according to the "Regulations", for the products listed under the licence; to take all appropriate steps for the protection of the label in ..... (country), to prevent its unauthorized or incorrect use and to safeguard the interests of the sub-licensee as the authorized user.

3. The GL and the sub-licensee agree herewith that the present contract shall continue valid until such time as the licence certificate, which shall be issued according to this contract, shall be withdrawn as stipulated in the "Specifications".

4. The right to use the quality label shall be limited to a period of one year. If all the above mentioned obligations of the sub-licensee are met, this right shall be continued, in each case for a further period of one year. If the qualifications for some reason lapse, the GL may give a four months' notice of termination. The sub-licensee is also entitled at all times and with immediate effect, to waive the right to use the quality label. In this case, the procedure for withdrawal of the licence set out in the "Regulations" shall apply.

Place, date: .....

The General Licence Holder (GL) The sub-licensee

....

APPENDIX IV - Abrasion Test for Anodic Oxidation Coatings (requirements)

1. Principle

The test is based on Mho's principle that a substance will only be scratched by a material harder than itself. The surface abrasion resistance of an anodic coating is therefore evaluated by using abrasive papers to determine whether or not the coating is harder than the abrasive paper used. It is essentially a go/no go test for anodic film quality.

2. Scope

The method described is mainly intended for use with anodic coatings of Class 20 or above intended for external architectural use. It is suitable for evaluating such coatings produced by sulphuric acid-based anodizing.

3. Apparatus

3.1 Glass coated paper, grade 00 (240 grit) as strips 12 mm wide and 150-200 mm long.

Note: This should be kept in a warm, dry place.

3.2 Resilient support for the paper during the test, 6 mm to 8 mm thick and approximately 30 mm wide and 40 mm long. Rubber is a suitable material and should have a hardness of between 30 and 70 International Rubber Hardness Degrees (IRHD).

4. Procedure

4.1 Test specimen

The test specimen shall normally consist of a production article (or part thereof), which has been fully processed and is clean and dry.

4.2 Test method

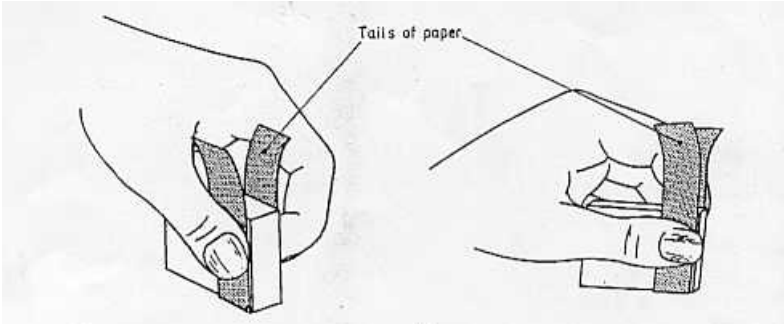
Wrap the glass-coated paper round the resilient block with the abrasive side outwards and lying across the narrow part of the block as shown in Figure 1. Hold the paper tightly in place as shown and pressing the abrasive strip firmly against the anodic oxide surface, make 10 double strokes (one double stroke is one passage backwards and forwards across the test area) with an amplitude of 25-30 mm. After 10 double strokes examine the part of the abrasive paper which has been in contact with the coating. A dense deposit of chalky white powder indicates that the coating is softer than the abrasive and the component shall be rejected.

No deposit indicates that the coating is harder than the abrasive, but a light powder deposit, not filling completely all the spaces between the abrasive particles, can indicate the removal of a very thin superficial sealing bloom. If in doubt, wipe the tested area clean with a dry cloth, lo-

cate a fresh area of abrasive paper over the edge of the block, and test again in the original area.

Note 1. It can be helpful to test a vertical surface so that any loose abraded particles fall away and do not themselves cause abrasion.

Figure 1



4.3 Measurement of thickness loss

A more quantitative result is obtained if the anodic film thickness removed in the abrasion test is measured. However, the film thickness measurements must be made with care and a small eddy-current probe is usually needed.

Test the work as indicated in 4.2 but making 50 double strokes in the same area. A fresh area of abrasive paper should be used after each 10 double strokes, and the abraded surface should be wiped clean at the same time. After completion of the 50 double strokes, wipe the surface of the component clean and measure the anodic coating thickness at several points in the centre of the abraded area using an eddy-current instrument with a small probe. Compare the value obtained with that for the unabraded coating adjacent to the abraded area.

A loss of more than 2 micrometres of coating will normally be a cause for rejection of the component.

APPENDIX V - Cleaning and Maintenance (for information)

Regarding section 3.1.5

Interior applications

Interior parts can normally be kept clean by wiping them periodically with a soft cloth. If they have not been cleaned for some time, a neutral cleaning fluid and soft cloth can be used, followed by rinsing in clear cold water. They can then be polished with a soft, dry cloth to make them look like new.

Exterior applications

In practice, the frequency with which structural components exposed to the atmosphere should be cleaned depends on the kind of parts and the aggressiveness of the environment.

For exterior applications where the decorative appearance and protective function are particularly important e.g. porches, entrances, shop fronts, etc., weekly cleaning is recommended. In this case, i.e. with regular cleaning, it is possible to use clean water and a chamois leather and then wipe the parts down with a soft dry cloth.

Window frames, windowsills and facades should be cleaned regularly, the frequency depending on the aggressiveness of the environment and the construction of the facades. This is best done with a neutral, synthetic cleaning fluid and a cloth, sponge, chamois leather or soft brush. Then rinse with clear water and rub slightly to dry.

Stubborn dirt can be removed with slightly abrasive cleaning agents or bonded fibres covered with fine neutral polishing powder.

If a preserving agent is applied to the structural components after cleaning, care should be taken that only an extremely thin water repellent film remains. This should not yellow, not attract dust and dirt nor have iridescent effects. Waxes, vaseline, lanolin and similar substances are not suitable.

Multi-purpose cleaners should meet the same requirements.

Soda solutions, alkalis and acids should always be avoided. Abrasive materials, metallic cloths, wire brushes, etc. should never be used.

APPENDIX VI - Assessment of New Products and Processes (requirements)

The Specifications define closely the procedures to be adopted by licensed anodizers. Inspectors ensure that these procedures are being followed. If an anodizer wishes to use a new process or product he should find out from QUALANOD whether it has been previously assessed. If not then he should apply to QUALANOD to have the process or product assessed. This would also apply if a supplier wishes to offer a new process or product for licensed anodizers to use.

The results of the assessment will be evaluated by the QUALANOD Technical Committee. If it decides that the assessment has been successful, then it will recommend to the Executive Committee that, as appropriate, an addendum to the Specifications should be introduced and the Inspectors should be instructed on new inspection requirements. The applicant will be notified of decisions of the Executive Committee.

The assessment shall comprise the following three stages:

A. The anodizer or supplier (producer) shall apply to QUALANOD to have a new process or product tested.

B. Independent tests shall be carried out in a laboratory accredited to EN 17025 and recognized by QUALANOD.

C. Samples shall be subject to outdoor weathering for three years.

The applicant shall bear all the costs associated with the sample preparation and testing of Stages B and C.

If a process or product approved by QUALANOD is not used by any anodizer over three years, it shall be necessary to repeat the laboratory tests following the same procedure as in paragraph B.

A. Application

The producer of a new product or process shall apply to the responsible General Licensee or, if there is no national association or General Licensee in the country concerned, directly to QUALANOD's secretariat. The General Licensee shall send the application to the QUALANOD secretariat which shall then inform the Technical Committee and circulate the application before its next meeting.

The application shall be written in English. It shall include a description of the process or product and a technical data sheet showing the most important properties. QUALANOD may ask for more information if necessary. The producer may decide whether it wants the application handled anonymously in this stage. If so, it shall make this clear in its application.

B. Laboratory tests

The national association or QUALANOD shall inform the applicant which laboratory shall be engaged to conduct the tests.

a) Panel preparation

Special care should be paid to the preparation of samples; they shall be free of defects. Due to the fact that the tests are comparative between two processes, it is important that the chemical composition and microstructure of the samples are the same. For this reason, if possible, the samples should come from the same profile or coil.

The samples may be prepared:

- In the laboratory recognised by QUALANOD
- in the supplier's laboratory under the supervision of the person in charge of the laboratory
- In an anodising plant under the supervision of the person in charge of the laboratory and the supplier

Samples produced with the new process or product shall be compared with reference samples produced using conventional methods following the Specifications. Unless the Technical Committee decides otherwise, the processing conditions for the reference samples shall be as follows:

1. Tests shall be performed on EN AW 6063 or 6060 extrusions.
2. Separate samples shall be anodized to class 15 and class 20, each class in the same anodizing batch.
3. Different samples of each class shall be left in the "natural" condition and coloured to a dark bronze using a tin-based electrolyte.
4. Samples shall be hydrothermally sealed in hot water.

Test samples representing the new process or product shall be produced using, as far as possible, the same processing conditions as the reference samples.

b) Testing

Each test shall be carried out on triplicate samples.

The series of tests shall comprise:

1. **weight loss test according to EN 12373-7 (section 2.3.3 of the Specifications);**
2. **admittance value according to EN 12373-5 (section 2.3.2 of the Specifications);**
3. **dye spot test according to EN 12373-4 (section 2.3.1 of the Specifications);**
4. **measuring the weight loss according to section 2.7 of the Specifications;**
5. **acetic acid salt spray test according to ISO 9227 (1000 hours) with evaluation according to EN 12373-18 or EN 12373-19;**
6. **abrasion test according to section 2.4.1 of the Specifications**

This means that there will be 8 sets of samples (2 classes x 2 colours x 2 processes) which will go forward for testing. Each set shall comprise at least 18 samples including 3 samples for each outdoor exposure location.

The test results shall be sent to the applicant and QUALANOD. Before the next meeting of the Technical Committee, the QUALANOD secretariat shall compile the results and submit them to the Technical Committee for evaluation. The Technical Committee shall decide whether the results conform with the Specifications and recommend whether the assessment should proceed to Stage C.

C. Outdoor exposure

Outdoor exposure tests shall be applied to samples produced with the new product or process and reference samples all prepared during Stage B, ie the two thickness classes, and natural and dark bronze finishes. The testing laboratory shall arrange for the samples (in triplicate) to be exposed at Genoa and the Hook of Holland for 3 years.

Before exposure a region about 2 cm wide at one edge of each sample shall be masked off. This will preserve the original appearance and enable any changes in appearance to be assessed after exposure. The samples shall not be cleaned during exposure (other than natural rain washing). One sample from each group of three shall be withdrawn after 12 months exposure, the remaining two after a further two years.

After the exposure periods (1 and 3 years) the testing laboratory shall return the samples without any cleaning to QUALANOD which shall submit them to the Technical Committee for evaluation at its next meeting. The Technical Committee shall decide whether the results are satisfactory and make recommendations to the Executive Committee accordingly.

QUALANOD may approve the use of the process or product by licensed anodizers on a provisional basis after one year of exposure or after laboratory tests. A final decision whether to grant an approval shall be taken after completion of 3 years of exposure.

APPENDIX VII - List of relevant standards

STANDARDS FOR QUALANOD SPECIFICATIONS (requirements)		
Nº	**TITLE**	**SPECIFICATIONS**
EN 12373-1:1998	Aluminium and aluminium alloys - Anodizing - Part 1: Method for specifying decorative and protective anodic oxidation	2.1
EN 12373-2: 1998	Aluminium and aluminium alloys - Anodizing - Part 2: Determination of mass per unit area (surface density) of anodic oxidation coatings. Gravimetric method.	2.2.2 b)
EN 12373-3: 1998	Aluminium and aluminium alloys - Anodizing - Part 3: Determination of thickness of anodic oxidation coatings. Non-destructive measurement by split-beam microscope.	2.2.1 b)
EN 12373-4: 1998	Aluminium and aluminium alloys - Anodizing - Part 4: Estimation of loss of absorptive power of anodic oxidation coatings after sealing by due test with prior acid treatment.	2.3.1
EN 12373-5: 1998	Aluminium and aluminium alloys - Anodizing - Part 5: Assessment of quality of sealed anodic oxidation coatings by measurement of admittance	2.3.2
EN 12373-7: 2002	Aluminium and aluminium alloys - Anodizing - Part 7: Assessment of quality of sealed anodic oxidation coatings by measurement of the loss after immersion in phosphoric acid/chromic acid solution with prior acid treatment.	2.3.3
EN 12373-9: 1998	Aluminium and aluminium alloys - Anodizing - Part 9: Measurement of wear resistance and wear index of anodic oxidation coatings using an abrasive wheel wear test apparatus.	2.4.2
EN ISO 1463:1997	Metallic and oxide coatings - Measurement of coating thickness - Microscopical method.	2.2.2 a) 2.2.3
EN ISO 2360: 2003	Non-conductive coatings on non-magnetics basis metals - Measurement of coating thickness - Eddy current method.	2.2.1 a)
ISO 2135: 1984	Anodising of aluminium an its alloys - Accelerated test of light fastness of coloured anodic oxide coatings using artificial light	2.5
ISO 7599:1983	Anodizing of aluminium and its alloys - Specifications for the oxide anodic coating of the products for construction.	------
ISO 7583: 1986	Anodised aluminium – Terminology	------
ISO 9227: 1990	Corrosion tests in artificial atmospheres - Salt spray tests	2.6

OTHER STANDARDS FOR ANODIZATION (for information)		
Nº	**TITLE**	**SPECIFICATIONS**
NF A91-451:1988	Anodised aluminium - Qualification of maintenance products	------
EN 12373-6: 1998	Aluminium and aluminium alloys - Anodizing - Part 6: Assessment of quality of sealed anodic oxidation coatings by measurement of the loss after immersion in phosphoric acid/chromic acid solution without prior acid.	------
EN 12373-8: 1998	Aluminium and aluminium alloys - Anodizing - Part 8: Determination of the comparative fastness to ultra-violet light and heat of coloured anodic oxidation coatings.	------
EN 12373-10: 2002	Aluminium and aluminium alloys - Anodizing - Part 10 - Measurement of mean specific abrasion resistance of anodic oxidation coatings using an abrasive jet test apparatus.	------
EN 12373-11: 2000	Aluminium and aluminium alloys - Anodizing - Part 11: Measurement of specular reflectance and specular gloss of anodic oxidation coatings at angles of 20º, 45º, 60º or 85º.	------
EN 12373-12: 2000	Aluminium and aluminium alloys - Anodizing - Part 12: Measurement of reflectance characteristics of aluminium surfaces using integrating-sphere instruments	------
EN 12373-13: 2000	Aluminium and aluminium alloys - Anodizing - Part 13: Measurement of reflectance characteristics of aluminium surfaces using a gonio-phpto meter or an abriged goniophptometer	------
EN 12373-14: 2000	Aluminium and aluminium alloys - Anodizing - Part 14: Visual determination of image clarity of anodic oxidation coatings - Chart scale method.	------
EN 12373-15: 2000	Aluminium and aluminium alloys - Anodizing - Part 15: Assessment of resistance of anodic oxidation coatings to cracking by deformation	------
EN 12373-16: 2001	Aluminium and aluminium alloys - Anodizing - Part 16: Check for continuity of thin anodic oxidation coating - Cooper sulphate test.	------
EN 12373-17: 2001	Aluminium and aluminium alloys - Anodizing - Part 17: Determination of electric breakdown potential	------
EN 12373-18: 2001	Aluminium and aluminium alloys - Anodizing - Part 18: Rating system for evaluation of pitting corrosion - Chart method.	------
EN 12373-19: 2001	Aluminium and aluminium alloys - Anodizing - Part 19: Rating system for evaluation of pitting corrosion - Grid method.	------
BS 6161-18 : 1991	Methods of test for anodic oxidation coatings on aluminium and its alloys. Part 18: Determination of surface abrasion resistance	2.4.1

APPENDIX VIII – Continuous Coil Anodizing (requirements)

Continuous coil anodizing is a special process where a coil of aluminium strip is unwound, fed through a series of process stations where etching, anodizing, colouring and sealing etc are carried out, and then rewound into coil at the end.

The process conditions and technologies are significantly different from the “normal” batch anodizing where discrete lengths of aluminium extrusion or sheet or small components such as castings are fixed to racks which are then transported by a crane and lowered sequentially into the different processing baths.

These conditions give the possibility to anodize faster than “normal” batch anodizing. Generally the strip is passed through the line at such a speed that anodizing has to be carried out more rapidly than in batch anodizing.

Continuous coil anodizing can produce a product equivalent to that produced by batch anodizing. However, there are significant differences. Particular process control must be applied to produce a good quality product by continuous coil anodizing. Thus certain inter-related process parameters must be closely controlled and ensured to be uniform across the width of the strip. These are:

1. strip speed
2. anodizing acid flow rate at the strip surface
3. anodizing acid temperature
4. anodizing acid concentration
5. anodizing current density

Heat dissipation is effected by the differential movement of the strip and counter-flowed anodizing acid which is recirculated through a heat exchanger. Thus air agitation of the acid generally becomes unnecessary. Poor heat dissipation can lead to excessive attack of the anodic coating surface by the acid depending on the acid concentration. The coating becomes more porous and softer. It is known that anodic coatings with such characteristics can exhibit performance deficiencies during weathering. The strip speed determines the contact time in the anodizing solution and thus the current density should be adjusted to achieve the required anodic coating thickness. But high current density causes local heating of the acid, which then should be dissipated into the acid. Clearly, different combinations of the four parameters can be chosen that would give the required anodic coating thickness without producing an unacceptably soft coating.

The product tests of in-house control should be used to ensure that the chosen continuous coil anodizing conditions are producing the correct product quality.

In-house control

The same criteria used in Chapter 4 shall be applied with the following deviations:

1. Testing the anodizing baths (section 4.2), bath temperature (section 4.3) and pH sealing bath (section 4.4)
   - once a day per anodizing line

2. Sealing (section 4.5):
   - Dye spot test: once per coil
   - Weight loss test:
     - once a shift per sealing bath per line where coloured anodised coil are produced
     - once a day per sealing bath per line where clear anodised coil are produced
3. Thickness (par 4.6): Every coil shall be checked at the beginning, in the middle and at the end.
4. Abrasion test (section 4.7): the abrasion tests (section 2.4) are suited to detect whether a soft coating has been produced. The abrasion resistance shall be measured for thickness classes 15 and greater. Every coil shall be checked at the beginning, in the middle and at the end.

Inspections

According to Chapter 5, these shall include at least:

- 1 weight loss test
- 150 thickness measuring points on
  - 3 running coils and
  - 9 coils on stock (or at least 1 coil of the stock and reference samples).