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

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This edition supersedes the previous edition (October 1999) and incorporates Update Sheets Nos. 1, 2 and 3.
It may be supplemented with new update sheets.

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Josef Schoppig

Mailing address: QUALANOD, P.O. Box 1507, CH-8027 Zurich
☎ ++41 43 305 09 70/79 - Fax ++41 43 305 09 98
E-mail: info@qualanod.net
Internet : www.qualanod.net

Domicile: QUALANOD, c/o AC-Fiduciaire SA,
Certification Body, Tödistrasse 47, CH-8002 Zurich
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Main changes compared with the 1999 edition

- Title changed (extending the applicability of the QUALANOD Specifications)
- The various supplements (green, red, blue) have been incorporated in the appropriate chapters
- Update Sheet No. 1 (abrasion resistance test) has been incorporated
- Update Sheet No. 2 (reinforcement of anodizers' in-house control) has been incorporated
- Update Sheet No. 3 (use of the logo by third parties) has been incorporated
- Former Appendix II «Allmendinger Testing Instructions II» has been replaced by a new reference to the EN 12373-7 standard in the text
- The reference to the EURAS coding defined in the old Appendix I has been deleted
- The name «EURAS/EWAA quality label» has been replaced by «QUALANOD quality label»
- The average rule (§ 8.3 of the 1999 edition of the Specifications) has been abolished.
- A list of relevant standards has been added.
- The chapters and appendices have been reorganized and renumbered
- New chart A «Procedure for obtaining the quality label»
- New chart B «Procedure for renewing the quality label »

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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 must be strictly observed by holders of the quality label. Special attention must be paid to the following points:

Obligations on the anodizers

Holders of the QUALANOD quality label must 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 must, in any case, follow the EN 12373-1 Standard. In such a case, the parts concerned must be clearly identified.

Thickness class

The thickness class of the anodic coating must 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 not conform to the Specifications nor 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 may be most noticeable in external applications and for coloured products..

Identification of parts inspected

The anodizer must indicate to the QUALANOD inspector which goods have passed the internal inspections. Goods that are kept in stock, ready for dispatch or ready, packed will 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 must also hold the quality label.

Chapter 2

Test Methods and Requirements

2. Test Methods and Requirements

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

The anodized parts must be free of visible defects on the significant surface(s) when viewed from a minimum distance of 5 m (exterior architectural applications), 3 m (interior architectural applications) or 0.5 m (decorative applications).

The extent of admissible variations in the final appearance and uniformity may be agreed by means of samples that have the required coating thickness and are acceptable to both parties. Optical inspection methods may also be used if necessary.

The colour should be assessed by comparing a part with reference samples. During this comparison, both the part and reference samples should be level with one another, oriented in the preferred direction (direction of rolling, extrusion or machining).

2.2. Thickness measurement

2.2.1 Non-destructive tests

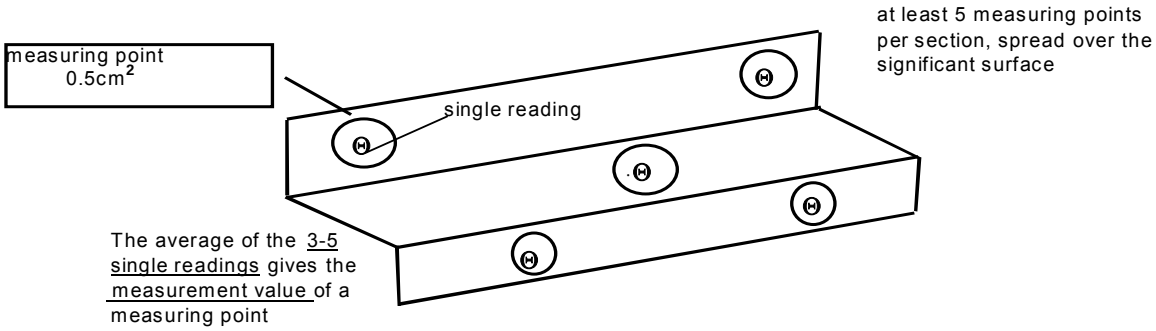
a) Eddy current test method according to EN ISO 2360

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

Procedure

The thickness of the film on each part to be tested should 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 is to be recorded in the inspection reports.

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



Requirements

The component's average thickness value expressed in micrometres must 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 will 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) is to be used as the referee test.

2.3. Sealing and impregnation tests

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) are acceptable. The values 3 to 5 are unacceptable.

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

This test is less sensitive to 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 is:

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

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 sealing on such coloured sections can be tested as follows:

The inspector should first measure the admittance of the relevant lot. Then the referee test should 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 is passed; if not, the result of inspection is to 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.

Maximum loss of mass: **30.0 mg/dm²**.

When a lot is to be inspected, the weight loss test should 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

2.4.1 Abrasion resistance test method

This test is based on BS 6161, Part 18 : 1991 (see Appendix IV)

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

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

2.4.2 Referee test

In cases of dispute, samples should be tested using the Abrasive Wheel Test Method (EN 12373 – 9). Samples having a Wear Index of less than1.4 are satisfactory.

2.5. Light fastness

For external applications, the dyes must have demonstrated good resistance in practice and must reach or exceed the figure of 8 on the international "Blue Scale", according to ISO 2135.

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 must specify the following:

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 must 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 must be used to produce certain colours.

3.1.2 Aspect

The appearance of the products depends on the surface treatment immediately prior to anodizing and must 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 variations in treatment by the anodizer.

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 must 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 permissible colour variations may be specified by means of samples that are acceptable to 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 must be made in writing. The anodizer must hold a register of complaints which includes actions taken.

3.2. Equipment of anodizing plants

3.2.1 Tanks

Material and lining

The material and/or lining of the tanks must 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 must 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 must 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 must be taken into consideration when calculating the total cooling capacity.

3.2.3 Agitation of the electrolyte

Good agitation of the electrolyte is essential to maintain constant temperature of the bath and remove the heat generated at the surface of the aluminium during the anodizing process.

Air agitation is extremely important for batch processing. 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 must 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 must be adjusted to give even agitation.

For batch processing, agitation of the electrolyte by pump circulation is not sufficient to maintain proper temperature control in the bath. Agitation is a vital factor in maintaining the electrolyte temperature around the work piece and any areas with insufficient agitation will lead to poor anodic film quality in these areas.

3.2.4 Heating

Heating capacity

The heating capacity of the individual baths must be related to the temperatures to be maintained during the various stages of treatment. In particular, it must be possible to maintain the temperature of the 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) must be capable of generating the current density specified in section 3.2.8 for a load at the maximum installed rectifier capacity.

Voltage regulation

It must 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 must be such that each division represents a maximum of 2% (volts) and 5% (amperes) of the total scale deflection.

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

When using current supplies with complicated frequency waveforms, care must 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 must be measured.

Contacts

The voltage drop across the busbar to flightbar contact must not be more than 0.3 volts; the temperature must 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 must 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 must 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 must 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 will lead to increased film thickness variation. Systems with central cathodes between the rows of workpieces are recommended.

3.2.7 Rinsing

At least one separate rinse must 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.

3.2.8 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 (see Appendix VI).

Sulphuric acid electrolytes

The concentration of free H_2SO_4 should be not more than 200 g/l, variable within $\pm$ 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 must 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 must be transferred from the anodizing electrolyte to the rinse as quickly as possible. They must 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.

3.2.9 Colouring

When colouring parts, anodizers should use dyes that satisfy the light fastness test (see section 2.5).

The dye supplier's instructions on the temperature and pH value of the dye bath and time of immersion must be followed depending on the dye employed.

The quality label may not be used for black electrolytic colouring using copper salts.

3.2.10 Sealing by hydrothermal treatment

Processes applying any principle other than hydrothermal treatment must be tested as stipulated in Appendix VI.

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.

The additive used and its application must be recorded in writing and submitted to the inspector so that he can verify that it is used correctly.

Steam sealing

The minimum temperature should be the saturated steam temperature.

3.2.11 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 3.2.8.

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 may 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 may 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 must 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 shall always constitute less than 3% of the powder product. Continuous filtration of the CI-CS bath is necessary.

[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.

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.

Operating parameters

The operating parameters for CI-CS are critically important and must 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 must 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 must 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 may 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] will 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 must 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.

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

Bath temperature

The bath must 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 must be maintained at 6 ± 0.5.

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 must be measured with utmost care as fluoride in the solution may 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 must 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 must 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 3.2.10 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 must 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 conventional 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.

3.2.12 Medium temperature sealing

Only systems approved by QUALANOD may be used for the purposes of the quality label. These systems should be used in accordance with the suppliers' written instructions approved by QUALANOD.

3.2.13 Storage

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

3.3. Laboratory and testing apparatus

3.3.1 Laboratory

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

3.3.2 Instruments for measuring thickness

The plants must 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).

3.3.3 Instruments and solutions for sealing tests

The plant must 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 following equipment is necessary to carry out the referee test stipulated in section 2.3.3 :

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

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

3.3.4 Apparatus for testing baths

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

3.3.5 Material for the abrasion resistance test

Suitable glass coated paper, grade 00 very fine, for abrasion testing must be available (see Appendix IV).

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. In the case of non conformity, the anodizer should take immediate remedial action and test further the corresponding production before sending it to the customer. All these actions must be registered.

4.1. Testing the anodizing baths

The anodizing baths must 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 must be entered in charts or some other records readily accessible to the inspector. The following data must 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 3.2.8 apply to typical anodizing conditions only. All different conditions accepted by QUALANOD must be recorded in writing and these records placed at the inspector's disposal so that he can verify that they were applied correctly.

4.2. Checking the bath temperature

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

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

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

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

4.3. Checking the pH of sealing baths

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

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

4.4. Sealing tests

4.4.1 Dye spot test

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

For natural or light-coloured anodized aluminium, the dye spot test must 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 must be carried out or the sealing has to be repeated and then the dye spot test performed. The results of any weight loss test and the results of the test must be entered in the production control register (see section 4.7).

The chemical supplier's instructions to prepare the solutions should 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.

4.4.2 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 4.4.1 apply; i.e. either a weight loss test must be carried out or the sealing has to be repeated if the measured value exceeds the limit value (20 µS).

4.4.3 Weight loss test

The weight loss test according to EN 12373-7 must 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 must 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 must be mentioned in the register.

4.5. Thickness test

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

The maximum and minimum values finally measured on the finished product should be entered in the production control register (see section 4.7).

4.6. Abrasion resistance test (see Appendix IV)

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

4.7. Production control

The anodizer must have a secure control system following the production and showing 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.

4.8. 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 will write a letter to the General Licensee giving explanations and proposing solutions;
2) the company will 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%

4.9. Marking and labelling

The anodizer must 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 must be recorded in the In-House control register.

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

Specifications for In-House control in Anodizing Plants

Object tested	Minimum frequency	Results
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 are to be entered in charts or some other records (2).
Temperature of the anodizing and sealing baths	Twice per bath in every shift, at regular intervals to be measured: - at the end of the anodizing cycle (anodizing bath). - :ten minutes after immersion (sealing bath)	The results are to be entered in charts or some other records (2).
pH of the sealing baths	Twice in every shift, at regular intervals	The results are to 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)	It is compulsory to repeat the weight loss test or reseal the parts if the result of the dye spot test is 2 or if the admittance value reaches the limit of 400/e µS/µm. The test results are to be recorded in the production control register.
Film thickness	Once per flight bar on the finished product.	Results to 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 4.8

Chapter 5

Licensing of Anodizing Plants

5. Licensing of Anodizing Plants

5.1. Granting of a licence

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

5.1.1 Inspection of finished products (P)

Except for the abrasion test which is indicative, all test results must be in accordance with the requirements of the Specifications.

5.1.1.1 Inspection of laboratory and testing apparatus

As specified in section 3.3 to ensure that the equipment is available and functional.

5.1.1.2 Sampling of parts

The tests on finished products should 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 is considered to be one test piece. Each part of a frame that has been mechanically screwed together comprises one test part. Constructions joined together by heat-insulating, nonconductive material are also to be taken to comprise separate parts.

5.1.1.3 Thickness measurement

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

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

Other parts: statistical control 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 must 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 have 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 should have a local thickness less than 80% of the thickness class

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

The sealing should 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 must satisfy the minimum requirements.

5.1.1.5 Destructive sealing test (weight loss test)

The two inspections for granting the quality label must 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 must be taken from sections that have already been tested and prepared by the anodizer as instructed by the inspector. The inspector must mark the samples to prevent them from being exchanged.

5.1.1.6 Abrasion resistance test

If the samples taken according to section 5.1.1.2 include samples of thickness classes 20 or 25, the inspector will perform the abrasion resistance test on one of those samples for information purposes.

5.1.1.7 Inspection of in-house control

The inspector must check whether the in-house control has been carried out and the results recorded fully.

5.1.1.8 Inspection of register of complaints

The inspector must 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 section 3.2.

5.1.3 Final assessment for granting a licence

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

The inspector submits the inspection report to the General Licensee.

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

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

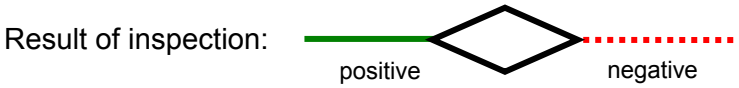
After an unsatisfactory inspection where plant and equipment have not met the requirements, another inspection will be made only when the company has given notification that it has rectified the deficiencies recorded.

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

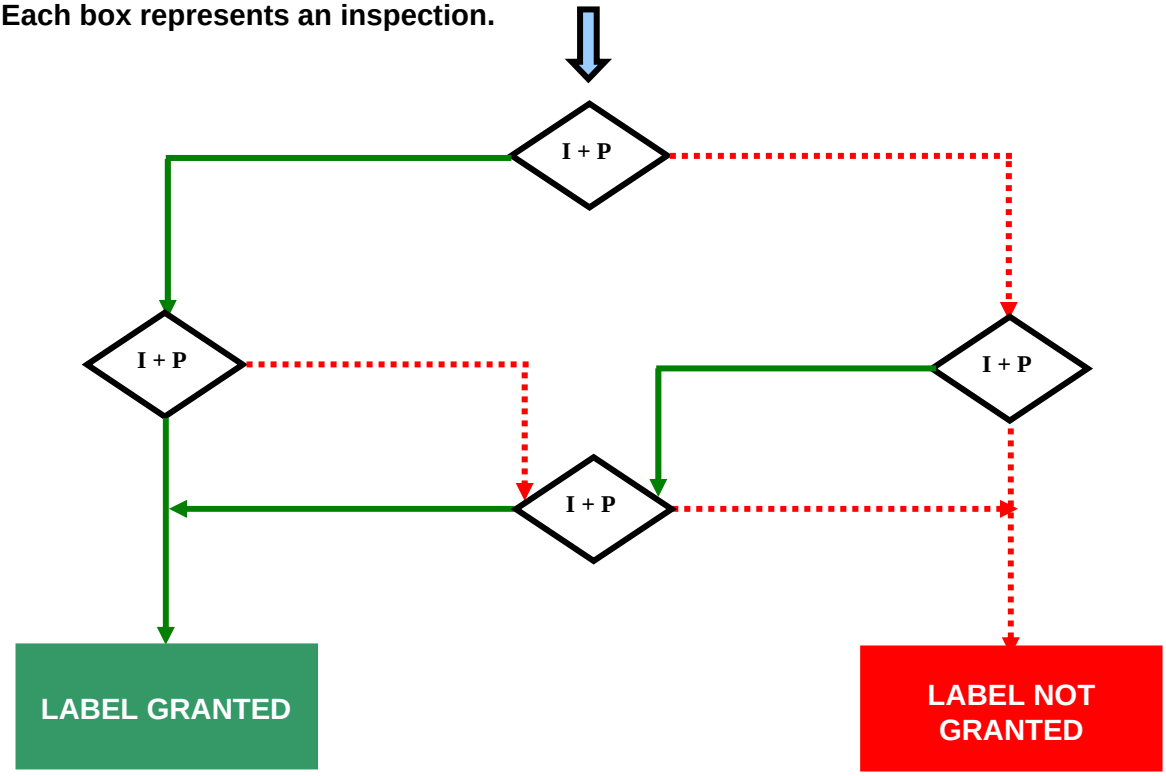
If a licence to use the quality label cannot be granted, the anodizer must wait six months before making a new application for a licence.

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)



Each box represents an inspection.



5.1.4 Contract with the General Licensee

When a licence has been granted, the sub-licensee and the General Licence holder should sign a contract. Appendix III gives a sample contract exhibing the minimum requirements.

5.2. Routine inspections of licensees

To renew a licence, a plant must go through the procedure set out in Diagram B below. Every licensee will have a product inspection at least twice but no more than five times each year. Routine inspections will be made without prior notice and must 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 will repeat the test with a new sample taken from the same part. This latter value will be decisive for the inspection.

If it is greater than 30.0 mg/dm², the inspector must 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 will report immediately to the General Licensee.

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

5.2.2 Plant inspection (I)

A plant inspection will be made regularly every two years.

5.2.3 Assessment of routine inspections

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

The inspector submits the inspection report to the General Licensee.

The inspection reports are assessed by the General Licensee. Under the supervision of QUALANOD, the General Licensee will 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 will be notified of the decision in writing.

If the results do not meet the requirements, the plant concerned will 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, will 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.

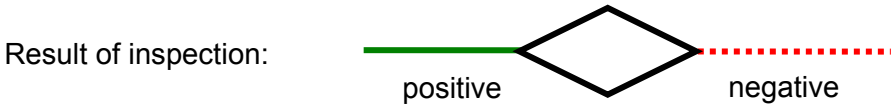
In addition to the normal repetition inspection to be carried out within one month if an inspection was unsatisfactory, an additional visit will be made within four months to verify the reinforcement of in-house control according to section 4.8.

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

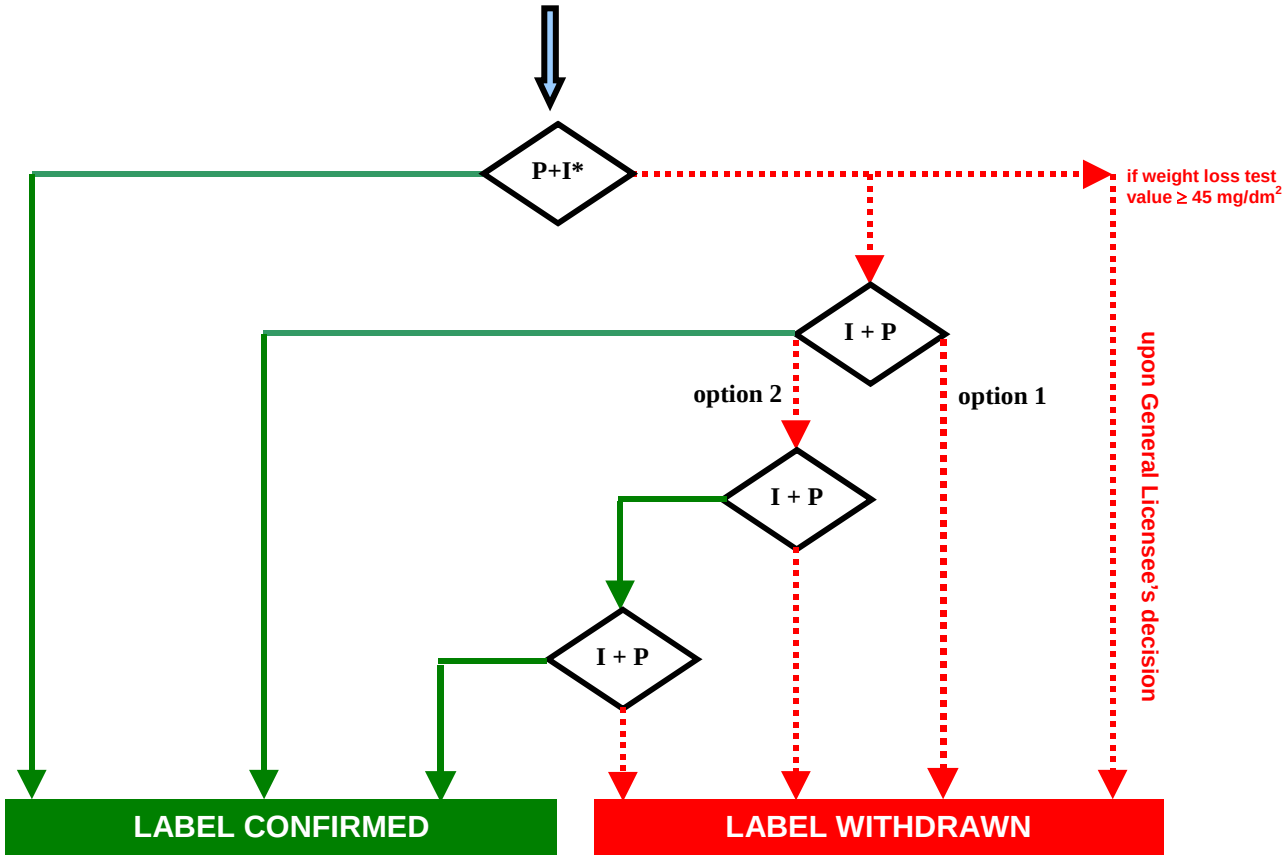
If a licence is withdrawn, the plant must wait at least six months before making a new application for a licence to use the quality label.

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)



Each box represents an inspection.



(*) plant inspection (I) at least every two years or whenever specified (see § 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 will receive a copy of each inspection report. If the results do not meet the requirements, full details and reasons must be given. The plant will be entitled to appeal within 10 days.

5.4. Confidentiality of information

All information concerning the inspection results and their assessment is confidential.

5.5. Deadlines for submission of inspection reports

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

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

Appendices

Appendices

APPENDIX I - Terminology*

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.

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

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.

IMPREGNATION OR SO-CALLED COLD SEALING OF ALUMINIUM

Treatment after anodizing consisting of impregnation based on nickel fluoride followed by ageing in a hot water treatment, which has the same function as sealing.

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

A hydrothermal treatment 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.

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

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 can 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

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 complying 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 the case may be, the quality ordered.

The thickness class must 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.

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 should no longer comply 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 are entitled to continue to use the quality label for three months pending the grant of a new licence unless the GL shall issue 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

Fig. 1

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

Fig. 2

The thickness class must 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 (for information) - Sample Sub-Licence Agreement concerning the QUALANOD quality label

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 should be discontinued the GL should 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 should come 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 will be borne by the misuser. If the allegation proves unjustified then the cost will 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 is limited to a period of one year. If all the above mentioned obligations of the sub-licensee are met, this right will be continued, in each case for a further period of one year. If the qualifications should 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" applies.

Place, date: .....

The General Licence Holder (GL) The sub-licensee

....

APPENDIX IV - Abrasion Test for Anodic Oxidation Coatings

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 12mm 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, 6mm 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

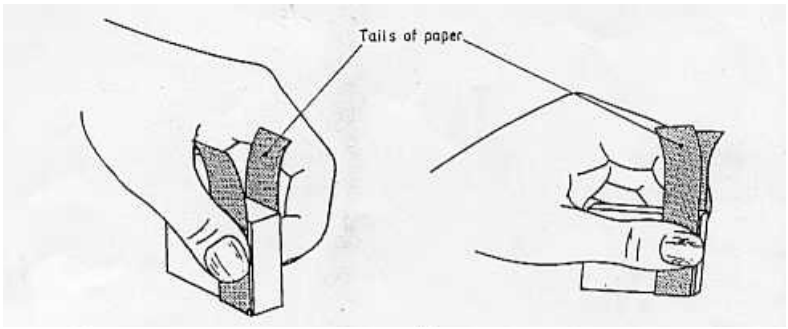
Wrap the glass-coated paper round the resilient block with the abrasive side outwards and lying across the narrow part of the block as shown in Figure 1. Hold the paper tightly in place as shown and pressing the abrasive strip firmly against the anodic oxide surface, make 10 double strokes (one double 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 should 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, locate a fresh area of abrasive paper over the edge of the block, and test again in the original area.

Note 1. It may 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

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 must 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 must not yellow, not attract dust and dirt nor have iridescent effects. Waxes, vaseline, lanolin and similar substances are not suitable.

Multi-purpose cleaners must meet the same requirements.

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

APPENDIX VI - Assessment Of New Products And Processes

The following three stages are planned:

A. Producer's application to QUALANOD to have a new product tested. Description of the process.

B. Independent tests in an accredited laboratory recognized by QUALANOD with positive results.

C. Outdoor weathering for three years. Granting of approval after positive exposure results.

A. Application

The producer or supplier of a new product or process applies 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 notifies QUALANOD about the application received. The secretariat then informs the Technical Committee, sending it the written documents before the next meeting. The producer can decide whether or not the application should be handled anonymously in the first stage.

A description of the product or process, written in German, French and English, must be submitted together with the application. A technical data sheet must also be prepared showing the most important properties. These documents will be submitted to QUALANOD's committees, if necessary confidentially, at the next meeting following the application.

B. Laboratory tests

An applicant must engage a laboratory approved by QUALANOD and accredited according to EN 17025 to conduct tests. Every test must be carried out on three samples. The series of tests comprises:

1. **Weight loss test according to EN 12373-7** (§ 2.3.3 of the Specifications)
2. **Admittance value according to EN 12373-5** (§ 2.3.2 of the Specifications)
3. **Dye spot test according to EN 12373-4** (§ 2.3.1 of the Specifications)
4. **Measuring the weight loss according to § 2.7** of the Specifications
5. **Acetic acid salt spray test according to ISO 9227** (1000 hours)
   Evaluation according to EN 12373-18 or EN 12373-19

Unless the QUALANOD Technical Committee decides otherwise, the tests are to be performed on EN AW 6063 or 6060 extrusions (natural anodized and coloured to a dark bronze using a tin-based electrolyte) with film thicknesses of 15 µm and 20 µm. Equivalent samples anodized and sealed according to the current specifications shall also be produced and tested with the new product.

The test results will be sent to the applicant and QUALANOD. The applicant must bear all the testing costs. QUALANOD takes the most important test results from the test report, compiles them appropriately and submits them to the Technical Committee for discussion, if possible in writing before the next meeting. The Technical Committee voices an opinion on whether the results comply with QUALANOD's specifications or not. It makes a recommendation to the Executive Committee if the results are satisfactory and the product can proceed to stage C.

C. Outdoor exposure

The panels prepared by the test laboratory will be exposed in Genoa and at Hook of Holland for 3 years.

APPENDIX VII - List of relevant standards

STANDARDS FOR QUALANOD SPECIFICATIONS		
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 9227: 1990	Corrosion tests in artificial atmospheres - Salt spray tests	2.6
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

OTHER STANDARDS FOR ANODIZATION		
Nº	**TITLE**	**SPECIFICATIONS**
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	------
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 goniophpto 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.	------