

Subject:	CLASS 3 POWDERS and SAMPLING OF POWDERS
Proposal:	“POWDERS” Working Group
QUALICOAT resolution:	Meeting in November 2006 (ratified on 21 June 2007)
Date of application:	July 2007
Amendments to the Specifications:	<p>Chapter 2 Test Methods and Requirements</p> <p>2.3. Coating thickness 2.6. Cupping test 2.7. Bend test 2.8. Impact test 2.10. Acetic acid salt spray resistance 2.12. Accelerated weathering test 2-13. Natural weathering test 2.17. Constant climate condensation water test</p> <p>Chapter 4 Approval of coatings</p> <p>4.1.2 Tests for granting an approval 4.2 Renewal of approved systems</p>



INTRODUCTION OF CLASS 3 IN THE SPECIFICATIONS



RULES FOR SAMPLING OF POWDERS



UPDATED SPECIFICATIONS (UPDATE SHEETS 1-10)

2. Test Methods and Requirements

The test methods described below are used to test finished products and/or coating systems for approval (see chapters 4 and 5).

For the mechanical tests (sections 2.6, 2.7 and 2.8), the test panels must be made of alloy AA 5005-H24 or -H14 (AlMg 1 - semihard) with a thickness of 0.8 or 1 mm, unless otherwise approved by the Technical Committee.

Tests using chemicals and corrosion tests should be performed on extruded sections made of AA 6060 or AA 6063.

2.1. Appearance

The appearance will be evaluated on the significant surface.

The **significant surface** must be defined by the customer and is the part of the total surface which is essential to the appearance and serviceability of the item. Edges, deep recesses and secondary surfaces are not included in the significant surface.

The coating on the significant surface must not have any scratches through to the base metal. When the coating on the significant surface is viewed at an oblique angle of about 60° to the upper surface, none of the defects listed below must be visible from a distance of 3 metres: excessive roughness, runs, blisters, inclusions, craters, dull spots, pinholes, pits, scratches or any other unacceptable flaws.

The coating must be of even colour and gloss with good coverage. When viewed on site, these criteria must be fulfilled as follows:

- for parts used outside: viewed at a distance of 5 m
- for parts used inside: viewed at a distance of 3 m

2.2. Gloss

ISO 2813 - using incident light at 60° to the normal.

Note: if the significant surface is too small or unsuitable for the gloss to be measured with the gloss meter, the gloss should be compared visually with the reference sample (from the same viewing angle).

REQUIREMENTS:

Category 1	:	0	-	30	+/-	5	units
Category 2	:	31	-	70	+/-	7	units
Category 3	:	71	-	100	+/-	10	units

(permissible variation from the nominal value specified by the coating supplier)

2.3. Coating thickness

EN ISO 2360

The thickness of the coating on each part to be tested must be measured on the significant surface in not less than *five measuring areas* (appr. 1 cm²) with *3 to 5 separate readings* taken in each area. The average of the separate readings taken in one measuring area gives a *measurement value* to be recorded in the inspection reports. None of the values measured may be less than 80% of the specified minimum value otherwise the thickness test as a whole will be considered unsatisfactory.

REQUIREMENTS:

Powders:

Class 1 ¹	:	60 µm
Class 2	:	60 µm
Class 3	:	50 µm
Two-coat powder system (classes 1 and 2)	:	110 µm
Two-coat PVDF powder system	:	80 µm

Liquid coating

Two-coat PVDF system	:	35 µm
Three-coat metallized PVDF system	:	45 µm
Silicon polyester without primer (minimum 20% silicon resin)	:	30 µm
Water-thinnable paints	:	30 µm
Other thermosetting paints	:	50 µm
Two-component paints	:	50 µm

<u>Electrophoretic coating</u>	:	25 µm
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Other coating systems may require different coating thicknesses, but may only be applied with the approval of the Executive Committee.

The results must be assessed as shown by **four typical examples** (minimum coating thickness for coatings of 60 µm):

Example 1:

Measured values in µm : 82, 68, 75, 93, 86 average: 81

Rating:

This sample is perfectly satisfactory.

Example 2:

Measured values in µm : 75, 68, 63, 66, 56 average: 66

¹ There are **three** different classes of powders that must meet different requirements. The particular class is stated in the approval.

Rating:

This sample is good because the average coating thickness is more than 60 µm and because no value measured is less than 48 µm (80% of 60 µm).

Example 3:

Measured values in µm : 57, 60, 59, 62, 53 average: 58

Rating:

This sample is unsatisfactory and comes under the heading "rejected samples" in table 5.1.4.

Example 4:

Measured values in µm : 85, 67, 71, 64, 44 average: 66

Rating:

This sample is unsatisfactory although the average coating thickness is more than 60 µm. The inspection must be considered failed because the measured value of 44 µm is below the tolerance limit of 80% (48 µm).

2.4. Adhesion

EN ISO 2409

The adhesive tape must conform to the standard (adhesive strength = (10 +/- 1) N per 25 mm width). The spacing of the cutters must be 1 mm for coating thicknesses of up to 60 µm, 2 mm for thicknesses between 60 µm and 120 µm, and 3 mm for thicker coatings.

REQUIREMENTS:

The result must be 0.

2.5. Indentation

EN ISO 2815

REQUIREMENTS:

Minimum 80 with the specified required coating thickness.

2.6. Cupping test

All powder systems except class 2 and 3 powders²: **EN ISO 1520**

Class 2 and 3 powders:

EN ISO 1520 followed by a tape pull adhesion test as specified below:

Apply an adhesive tape (see section 2.4) to the coated side of the test panel following the mechanical deformation. Cover the area by pressing down firmly against the coating to eliminate voids or air pockets. Pull the tape off sharply at right angles to the plane of the panel after 1 minute.

² See previous footnote.

REQUIREMENTS:

- Minimum 5 mm for powder coatings (classes 1, 2 and 3)
- Minimum 5 mm for liquid coatings except
 - two-component paints and lacquers : minimum 3 mm
 - water-thinnable paints and lacquers : minimum 3 mm
- Minimum 5 mm for electrophoretic coatings

To be indicative, the test must be performed on a coating with a thickness approximating the minimum required.

Viewed with the naked eye, the coating must not show any sign of cracking or detachment, except for class 2 and 3 powders.

Class 2 and 3 powders:

Viewed with the naked eye, the coating must not show any sign of detachment following the tape pull adhesion test.

2.7. Bend test

All powder systems except class 2 and 3 powders: **EN ISO 1519**

Class 2 and 3 powders:

EN ISO 1519 followed by a tape pull adhesion test as specified below:

Apply an adhesive tape (see section 2.4) to the coated side of the test panel following the mechanical deformation. Cover the area by pressing down firmly against the coating to eliminate voids or air pockets. Pull the tape off sharply at right angles to the plane of the panel after 1 minute.

To be indicative, the test must be performed on a coating with a thickness approximating the minimum required.

REQUIREMENTS:

Bending around a 5 mm mandrel, or an 8 mm mandrel for two-component and water-thinnable paints and lacquers.

Viewed with the naked eye, the coating must not show any sign of cracking or detachment, except for class 2 and 3 powders.

Class 2 and 3 powders:

Viewed with the naked eye, the coating must not show any sign of detachment following the tape pull adhesion test.

2.8. Impact test

(for powder coatings only)

The impact must be applied to the back side, whereas the results must be assessed on the significant side.

- Class 1 powders (one- and two-coat), energy: 2.5 Nm: **EN ISO 6272 / ASTM D 2794** (impactor diameter: 15.9 mm)

- Two-coat PVDF powders, energy: 1.5 Nm: **EN ISO 6272 / ASTM D 2794** (impactor diameter: 15.9 mm)
- Class 2 and 3 powders, energy: 2.5 Nm: **EN ISO 6272 / ASTM D 2794** (impactor diameter: 15.9 mm;) followed by a tape pull adhesion test as specified below.

Apply an adhesive tape (see section 2.4) to the coated side of the test panel following the mechanical deformation. Cover the area by pressing down firmly against the coating to eliminate voids or air pockets. Pull the tape off sharply at right angles to the plane of the panel after 1 minute.

To be indicative, the test must be performed on a coating with a thickness approximating the minimum required.

REQUIREMENTS:

Viewed with the naked eye, the coating must not show any sign of cracking or detachment, except for class 2 and 3 powders.

Class 2 and 3 powders:

Viewed with the naked eye, the coating must not show any sign of detachment following the tape pull adhesion test.

2.9. Resistance to humid atmospheres containing sulphur dioxide

EN ISO 3231 (0,2 l SO₂ - 24 cycles). A cross-cut incision with a width of 1 mm must be made to cut the coating down to the metal.

REQUIREMENTS:

No infiltration exceeding 1 mm on both sides of the scratch, and no change in colour or blisters in excess of 2 (S2) according to ISO 4628-2.

2.10. Acetic acid salt spray resistance

ISO 9227 (testing time: 1000 hours). A cross-cut incision with a width of 1 mm must be made to cut the coating down to the metal. The test must be carried out on three extruded sections of AA 6060 or AA 6063.

Classes 1 and 2: testing time: 1000 hours

Class 3: testing time: 2000 hours

REQUIREMENTS:

No blistering in excess of 2 (S2) according to ISO 4628-2. An infiltration of maximum 16 mm² is allowed over a scratch length of 10 cm but the length of any single infiltration must not exceed 4 mm.

The inspector takes three samples of different sections from different lots. The results are classified according to the scale below:

- A. 3 samples satisfactory = 0 sample unsatisfactory
 B. 2 samples satisfactory = 1 sample unsatisfactory
 C. 1 sample satisfactory = 2 samples unsatisfactory
 D. 0 sample satisfactory = 3 samples unsatisfactory

Rating :

	APPROVAL	LICENCE
A	Satisfactory	Satisfactory
B	Satisfactory	Satisfactory with a comment to the coating plant
C	Unsatisfactory	Repetition of the acetic acid salt spray resistance test. If the result of this second test is A or B, the inspection is satisfactory, otherwise it is unsatisfactory.
D	Unsatisfactory	Unsatisfactory

2.11. Machu test

(Accelerated corrosion test, on sections only)

Before immersion, a cross-cut incision with a width of 1 mm must be made with a special tool to cut the coating down to the metal.

Test solution :

- NaCl : 50 ± 1 g/l
 CH₃COOH (Glacial) : 10 ± 1 ml/l
 H₂O₂ (30%) : 5 ± 1 ml/l
 Temperature : 37° ± 1°C
 Testing time : 48 ± 0.5 hours

The pH of this solution is 3.0 - 3.3. After 24 hours, another 5 ml/l of hydrogen peroxide (H₂O₂ 30%) should be added and the pH adjusted with glacial acetic acid or caustic soda. A new solution must be prepared for each test.

REQUIREMENTS:

No infiltration exceeding 0.5 mm on both sides of the scratch.

2.12. Accelerated weathering test

EN ISO 11341

- Luminous intensity : 550 ± 20 W/m² (290 - 800 nm)
 Black standard temperature : 65 ± 5°C

Demineralised water: maximum 10 µS

Special UV filter (290 nm)

Cycles of 18 minutes in a wet medium and 102 minutes in a dry medium

After 1000 hours of exposure (2000 hours for class 3), the samples should be rinsed with fully demineralised water and checked for:

- Gloss variation: ISO 2813
angle of incidence 60°
- Colour change: ΔE CIELAB formula according to ISO 7724/3, with gloss.

3 colour measurements are to be made on the weathered sample and on the unexposed reference sample.

For class 3, the samples must be tested together with a reference sample indicated by QUALICOAT. Gloss and colour variation must be checked every 500 hours.

REQUIREMENTS:

Gloss retention: the loss of gloss after the accelerated weathering test must not be greater than 50% of the original value, or 10% for class 2 and class 3 powders.

Colour change: according to the ΔE values stipulated in the annexed table. For class 2 and class 3 powders, the ΔE colour change must not be greater than 50% of the limits prescribed in the annexed table (see Appendix A7).

2.13. Natural weathering test

Exposure in Florida according to ISO 2810.

The test must start in April.

Class 1 powders

Samples must be exposed to the elements facing 5° south for **1 year**.

4 test panels per colour shade are required (3 for weathering and 1 reference panel)

Class 2 powders

Samples must be exposed to the elements facing 5° south for **3 years with an annual evaluation**.

10 test panels per colour shade are required (3 per year for weathering and 1 reference panel).

Class 3 powders

Samples must be exposed to the elements facing 45° south for **10 years**.

13 test panels per colour shade are required (12 for weathering and 1 reference panel).

All the samples must be cleaned and measured annually by the laboratory in Florida.

After 1, 4 and 7 years, 3 samples will be sent back to the QUALICOAT laboratory in charge for evaluation. The remaining 3 samples will finally be sent back to the laboratory in charge at the end of the 10-year exposure period.

For all classes:

Dimensions of the samples: approx. 100 x 305 x 0.8 - 1 mm

After exposure, the exposed samples are to be cleaned using the following method:

Immersion in demineralised water with a 1% surface-active agent for 24 hours, then cleaning by wiping with a soft sponge soaked with an aqueous solution of a 1% surface-active agent, applying gentle pressure, or using any other method approved by the Technical Committee. This process must not scratch the surface.

The gloss is to be measured according to ISO 2813, at an angle of 60°.

The average is taken from the colorimetric measurements. The conditions for measurement and colorimetric evaluation are:

- Colour variation: ΔE CIELAB formula according to ISO 7724/3, measurement including specular reflection.
- The colorimetric evaluation must be made for the standard illuminant D65 and the ten-degree normal observer.

To determine the gloss and colour, three measurements will be made on the cleaned, weathered samples and on the unexposed reference panels. These measurements are to be made at different points at least 50 mm apart.

REQUIREMENTS:

Gloss

The residual gloss must be at least 50% of the original gloss.

The following values apply to class 2 powders and liquid coatings:

- After 1 year in Florida : at least 75%
- After 2 years in Florida : at least 65%
- After 3 years in Florida : at least 50%

The following values apply to class 3 powders:

- After 1 year in Florida : at least 90%
- After 4 years in Florida : at least 70%
- After 7 years in Florida : at least 55%
- After 10 years in Florida : at least 50%

Colour change

The ΔE values must not exceed the maximum values prescribed in the annexed table (see Appendix A7).

The following values apply to class 2 powders and liquid coatings:

- After 1 year in Florida: not greater than 65% of the limits prescribed in the table
- After 2 years in Florida: not greater than 75% of the limits prescribed in the table
- After 3 years in Florida: within the limits prescribed in the table

For class 3, the ΔE value after 10 years in Florida must not exceed 5.

2.14. Polymerisation test

Prescribed solvent for liquid coatings: MEK or as specified by the paint or lacquer manufacturer and approved by the Technical Committee.

Prescribed solvent for powder coatings: xylene or as specified by the paint or lacquer manufacturer and approved by the Technical Committee.

Saturate a swab of cotton wool with solvent. Within 30 seconds, rub it lightly back and forth 30 times in each direction over the part to be tested. Wait 30 minutes before making the assessment.

The polymerisation quality is assessed according to the following ratings:

1. The coating is very dull and quite soft.
2. The coating is very dull and can be scratched with a fingernail.
3. Slight loss of gloss (less than 5 units)
4. No perceptible change. Cannot be scratched with a fingernail.

REQUIREMENTS:

Ratings 3 and 4 are satisfactory.

Ratings 1 and 2 are unsatisfactory.

For powder coatings, this test is optional in in-house control; it is merely indicative and cannot alone cast doubt upon the quality of the coating.

2.15. Resistance to mortar

The test must be performed according to the **ASTM D 3260** standard. The mortar should be made of sand, lime and water. This represents type N according ASTM C 207. The testing time is 24 hours.

REQUIREMENTS:

The mortar must be easy to remove without leaving any residues. Any mechanical damage to the coating caused by grains of sand should be disregarded. There must not be any change in appearance/colour after the mortar test.

2.16. Resistance to boiling water

Method 1 with boiling water:

2 hours in boiling, demineralised water (maximum 10 μ S at 20°C). Remove the sample and allow it to cool down to room temperature. Apply an adhesive tape (see section 2.4) to the surface, ensuring that no air is trapped. After one minute, remove the tape at an angle of 45° with a sharp even pull.

Method 2 with a pressure cooker :

(to be used for powder and electrophoretic coatings only)

Add demineralised water (maximum 10 μ S at 20°C) to a pressure cooker with an internal diameter of about 200 mm to a depth of 25 mm and place a test sample measuring 50 mm in it.

Place the lid in position and heat the pressure cooker until steam escapes from the valve. The weighted needle valve must be adjusted to produce an internal pressure of 100 +/- 10 kPA (1 bar). Continue heating for 1 hour, timing from the moment when steam first escapes from the valve. Cool the pressure cooker, remove the sample and allow it to cool down to room temperature.

Apply an adhesive tape (see section 2.4) to the surface, ensuring that no air is trapped. After one minute, remove the tape at any angle of 45° with a sharp even pull.

REQUIREMENTS:

No blistering in excess of 2 (S2) according to ISO 4628-2. There must not be any defects or detachment. Some colour change is acceptable.

2.17. Constant climate condensation water test

DIN 50017

A cross-cut incision with a width of at least 1 mm must be made to score the coating down to the metal.

The test duration is 1000 hours for classes 1 and 2, and 2000 hours for class 3.

REQUIREMENTS:

No blistering in excess of 2 (S2) according to 4628-2; the maximum infiltration at the cross is 1 mm.

2.18. Sawing, milling and drilling

Good coating quality is tested using sharpened tools suitable for aluminium.

REQUIREMENTS:

The coating must not crack or chip when sharp tools are used.

4. Approval of Coatings

The powder and liquid coatings used in quality label coating must be approved before they may be used.

When a two-coat system (primer and coloured topcoat) approved by QUALICOAT is used, the coating plant may apply either a class 1 or class 2 topcoat on the approved primer. It is not necessary to have two systems approved. However, the two system components used by the coating plant must originate from the same supplier.

It is not permissible to apply a second coat for systems that are intended and approved for the application of one coat.

Any modification of the chemical properties of the binder (resin(s) and/or hardening agent(s)) is tantamount to a new product and absolutely requires a new QUALICOAT approval (see Appendix A3). Furthermore, if the physical appearance of the final coating is modified, the powder manufacturer must obtain a specific QUALICOAT approval and may not use the approval granted for a smooth coating (see Appendix A3).

4.1. Granting of an approval

Paint systems have a reference identifying a specific chemical formulation. Every system may have a variety of gloss levels (matt, satin and/or gloss) and finishes (see Appendix A3). Approvals are granted for each system, gloss level and finish.

Approvals are usually requested by the manufacturers themselves, but any third party interested may apply for approval of a system he wishes to sell under his own brand name provided that he clearly informs the national association and QUALICOAT of the sources used. An approval is granted for one single production site. If an approval holder changes his source, he must advise the national association and QUALICOAT and have such new systems tested.

In order for an approval to be granted, the following conditions must be met:

4.1.1 Minimum laboratory equipment

- 1) Gloss meter
- 2) Impact tester
- 3) Apparatus for testing adhesion and elasticity (cupping test)
- 4) Thickness gauge

4.1.2 Tests for granting an approval

The following tests must be made:

- 1) Gloss (2.2)
- 2) Coating thickness (2.3)
- 3) Adhesion (2.4)
- 4) Indentation (2.5)
- 5) Cupping test (2.6)
- 6) Bend test (2.7)
- 7) Impact test (2.8)
- 8) Resistance to humid atmospheres (2.9)

- 9) Acetic acid salt spray resistance (2.10)
- 10) Accelerated weathering test (2.12)
- 11) Polymerisation test (2.14)
- 12) Resistance to mortar (2.15)
- 13) Resistance to boiling water (2.16)
- 14) Condensation water test (2.17)
- 15) Natural weathering (Florida) (2.13)

The tests must be made on three test panels (for mechanical tests) and on three sections (for corrosion tests) coated by a laboratory approved by the Executive Committee. The average of the three samples will be taken to determine the results.

For classes 1 and 2, the following colours must be tested in triplicate:

- white RAL 9010
- blue RAL 5010
- red RAL 3005

plus a metallic colour (see Appendix A4) unless the supplier states in writing that no metallic colour is produced for the system concerned.

For class 3, the following colours must be tested in triplicate:

- blue
- light grey
- metallic colour

Not all the colours are suitable for use for class 3. Therefore it is the responsibility of the supplier to indicate the critical colours.

The inspector prepares the test panels in the testing laboratory using the coating materials supplied by the manufacturer and performs the above tests on them. The test panels may also be coated elsewhere provided that the inspector is present during the whole time of treatment. The inspector must always select the minimum stoving time and temperature specified by the manufacturer.

A preliminary visit may be required by the general licensee or by QUALICOAT in countries without a national association. The costs of such a visit will be paid by the applicant. If a visit is considered unsatisfactory, the general licensee (or QUALICOAT) retains the right not to grant the approval.

The inspector submits the inspection report to the general licensee.

The inspection reports are assessed by the general licensee. Under the supervision of QUALICOAT, the general licensee decides whether or not to grant an approval.

- If the results of tests 1 to 14 on the basic colours do not meet the requirements, the manufacturer of the product tested will be informed that no approval can be granted for the time being, stating the details and reasons.
- If the results of tests 1 to 14 are satisfactory for the metallic colour but not for the basic colours, the manufacturer of the product tested will be informed that no approval can be granted for the time being, stating the details and reasons.
- If the results of tests 1 to 14 on the basic colours and on the metallic colour meet the requirements, an approval will be granted for all colours provided.

- If the results of tests 1 to 14 meet the requirements for the basic colours but not for the metallic one, an approval will be granted for all colours excluding the metallic ones.

The manufacturer must wait at least three months to have tests 1 to 14 repeated.

The approval will be confirmed if the results of test 15 (natural weathering test in Florida) are satisfactory for the three basic colours and the metallic colour. If the result is unsatisfactory for the metallic colour alone, the approval will be maintained for all colours except metallic ones. In all other cases, the approval will be withdrawn.

4.2. Renewal of approved systems

Consistent quality of approved systems is monitored annually with tests 1 to 15 (see section 4.1) being performed on two colours chosen from the three colours specified by QUALICOAT each year. One metallic colour (RAL 9006 or RAL 9007) must also be tested every year, unless the supplier states in writing that no metallic colour is produced for the system concerned.

For class 3, two colours must be tested in a laboratory every year. Two colours must also be sent to Florida every five years. QUALICOAT will indicate the two colours for the renewal.

If a powder manufacturer fails for any reason to submit the required colours to the laboratory on time and if no panels are sent to Florida as a result, two of the colours and one metallic colour will be banned, as specified by QUALICOAT.

A visit to the powder manufacturer's plants is required every five years in order to check the laboratory equipment and simultaneously take samples for routine testing.

There are three options for sampling systems to be tested for renewal of approvals:

- The inspector takes samples of the required colours during routine inspections at the coating plants.
- The inspector takes samples directly at the system supplier's premises.
- The supplier sends samples of the colours to the inspector. In countries where there is neither a national association nor a testing laboratory, the coating suppliers must send the selected colours to a laboratory approved by QUALICOAT.

The inspector submits the inspection report to the general licensee.

The inspection reports are assessed by the general licensee. Under the supervision of QUALICOAT, the general licensee decides whether to renew or withdraw the approval.

- If the results of tests 1 to 14 do not meet the requirements, tests 1 to 14 must be repeated within one month, using samples taken from a different lot, before submission to the Florida test.
- If the results of this second series of tests are again unsatisfactory, the system will remain approved except for the colour(s) which produced unsatisfactory results. For class 3, if the residual gloss after the accelerated weathering test is between 85 and 90%, the system will remain approved but the colour which produced unsatisfactory results will be sent to Florida.
- If the results of tests 1 to 14 are satisfactory, the natural weathering test in Florida will be started³. If one (or more) of the colours tested annually produce(s) an unsatisfactory

³ Every five years for class 3 powders

result, the system concerned will continue to be approved with the exception of the unsatisfactory colour(s).

QUALICOAT will publish a list of all colours (currently) banned.

The suppliers must have banned colours tested again. As soon as three banned colours⁴ are registered for any one system, the supplier must submit the three basic colours for another series of QUALICOAT tests. If one of the basic colours produces an unsatisfactory result, the approval will be cancelled. If the results for the basic colours are satisfactory, the approval will be maintained but the banned colours will remain banned.

For classes 1 and 2, the approval will be withdrawn if more than five banned colours are registered.

For class 3, the approval will be cancelled if three colours are banned.

As soon as an approval is cancelled, the supplier must stop using any reference to the approval when selling the coating concerned.

4.3. Use of the logo by coating manufacturers

The use of the logo must comply with the Regulations for use of the QUALICOAT quality label (Appendix A1).

⁴ In applying this rule, only new colours banned will be counted.