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Anodizing of aluminium and its alloys — Method to test the surface abrasion resistance using glass-coated abrasive paper

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 79, *Light metals and their alloys*, Subcommittee SC 2, *Organic and anodic oxidation coatings on aluminium*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Surface abrasion resistance is a valid method of assessing the weathering resistance of an anodic oxidation coating. The higher the anodizing electrolyte concentration and temperature and the longer the immersion time in the electrolyte, the lower will be the abrasion resistance of the coating. In general, the lower the abrasion resistance the more likely the coating is to develop chalking in service.

Whole articles can be used for this test and, for those passing the test, it is non-destructive.

Anodizing of aluminium and its alloys — Method to test the surface abrasion resistance using glass-coated abrasive paper

1 Scope

This document specifies a method for the determination of the surface abrasion resistance of anodic oxidation coatings produced by sulfuric acid anodizing of aluminium and its alloys. It is mainly intended for the evaluation of external architectural coatings. It is a production control method that relies to a large extent on operator experience and instruction.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 48-2, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 2: Hardness between 10 IRHD and 100 IRHD*

ISO 2143, *Anodizing of aluminium and its alloys — Estimation of loss of absorptive power of anodic oxidation coatings after sealing — Dye-spot test with prior acid treatment*

ISO 2360, *Non-conductive coatings on non-magnetic electrically conductive base metals — Measurement of coating thickness — Amplitude-sensitive eddy-current method*

ISO 3210, *Anodizing of aluminium and its alloys — Assessment of quality of sealed anodic oxidation coatings by measurement of the loss of mass after immersion in acid solution(s)*

ISO 7583, *Anodizing of aluminium and its alloys — Terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7583 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
block
resilient support for the abrasive paper during the test

3.2
double stroke
one complete reciprocal movement across the measuring area on the test specimen

3.3
glass-coated abrasive paper
abrasive paper used for the surface abrasion-resistance test

3.4
lot
customer's complete order of one product

4 Principle

The surface abrasion resistance is evaluated by using an abrasive paper to determine whether or not the coating is more wear resistant than the glass-coated abrasive paper.

5 Apparatus

5.1 Glass-coated abrasive paper.

The backing paper shall be of such quality that the paper does not break during the performance of the test.

The glass-coated abrasive paper shall have been validated using the method described in Annex A.

NOTE Glass-coated abrasive paper with a very fine glass grit size equivalent to P240, as defined in ISO 6344-1, can be suitable to carry out this test.

5.2 Resilient support for the paper during the test.

It is recommended that the block is 6 mm to 8 mm thick and approximately 30 mm wide and 40 mm long. Its hardness shall be 30 IRHD to 70 IRHD (international rubber hardness degrees) as measured using an appropriate method described in ISO 48-2.

NOTE It is possible that a large rectangular rubber or soft-plastic pencil eraser is suitable.

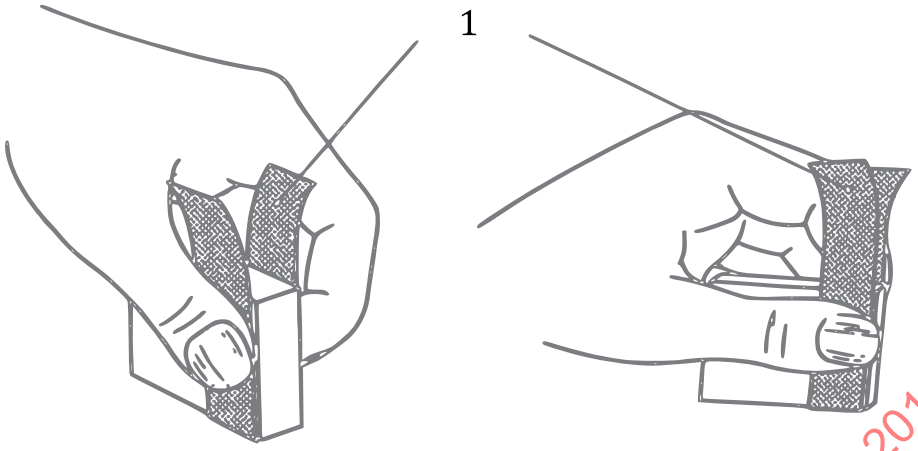
6 Procedure

6.1 Test specimen

The test specimen shall normally consist of a production article (or part thereof). It shall be sealed, dry and clean and, if requested, shaped to correspond to its ultimate use in service.

6.2 Method 1

Wrap a strip of glass-coated abrasive paper round the block so that the abrasive side lies outwards. Position the strip across the 6 mm to 8 mm thickness of the block so that the ends of the strip can be held firmly in place by the thumb and forefinger on either side of the block and position the strip so that it lies across the leading end of the block as it is held (see Figure 1).



Key

1 tails of paper

Figure 1 — Position of abrasive paper on block

Press the abrasive strip backed by the block against the anodic oxide surface and, applying a firm pressure, make 10 double strokes with amplitude of 25 mm to 30 mm keeping to the same track along the surface. After 10 double strokes, lift the block and examine that part of the abrasive paper which has been in contact with the anodic oxidation coating.

A dense deposit of chalky, white powder on the abrasive surface of the paper, abraded from the anodic oxidation coating, indicates that the coating is softer than the abrasive; no deposit indicates that the coating is more wear resistant than the abrasive.

A light deposit of powder not filling completely all the spaces between the abrasive particles can indicate the removal of very thin, superficial sealing smut. If in any doubt, wipe clean the test area with a clean, dry cloth, locate a fresh area of abrasive paper over the edge of the block and repeat the test on the same test area. A dense, chalky powder deposit on the abrasive paper indicates an anodic oxidation coating softer than the abrasive; no deposit indicates a coating more wear resistant than the abrasive.

NOTE An anodic oxidation coating abraded by the glass-coated abrasive paper, and thus softer than the glass, has a wear index greater than 1,4 when measured by the abrasive wheel wear test described in ISO 8251.

6.3 Method 2

Test as in method 1 but make 50 double strokes and provide a fresh area of abrasive paper after every 10 double strokes. After completion of the abrasion, measure the anodic oxidation coating thickness in the centre of the abraded track using an eddy current meter as described in ISO 2360 and compare the value obtained with that for the unabraded coating adjacent to the wear track. A loss of more than 2 µm can indicate that the coating is less wear resistant than the abrasive.

NOTE 1 It is possible that the abraded site will appear to gain thickness if the anodic oxidation coating is more wear resistant than the abrasive due to abrasive being transferred from the paper to the test site.

NOTE 2 The variability of the eddy current method is about 10 % (see ISO 2360).

NOTE 3 Surface roughness with *Ra* in excess of 0,5 µm can affect thickness measurements.

7 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 18771;

b) identification of the test specimen;

c) a reference to the method used;

d) the abrasive paper used (manufacturer, product identification and, if available, lot number);

e) the location of the test area on the test surface;

f) the result of the test;

g) the date of the test.

Annex A
(normative)

Method of validating glass-coated abrasive paper used for the surface abrasion test by applying tests with standard specimens of anodized aluminium

A.1 General

This annex describes a method of validating glass-coated abrasive paper to determine whether it may be used to assess the surface abrasion resistance of anodized aluminium.

A.2 Principle

Glass-coated abrasive paper is assessed by using two standard specimens of anodized aluminium. The standard specimens are prepared so that acceptable glass-coated abrasive paper is more wear resistant than one standard specimen but less wear resistant than the other.

A.3 Preparation of standard specimens

A.3.1 General

All the process conditions used to prepare the standard specimens shall be recorded.

A.3.2 Standard specimen that is more wear resistant than acceptable glass-coated abrasive paper

A.3.2.1 Aluminium specimen

Aluminium: AA 5005 or AA 1050 or, if necessary, another aluminium alloy on which anodic oxidation coatings with uniform thickness can be made

Heat treatment: H24 (or H14)

Thickness: 1,0 mm to 2,0 mm

Surface roughness: 0,5 µm *Ra* or less

Standard size: 140 mm × 70 mm

A.3.2.2 Pretreatment

A light brushing to maintain *Ra* of 0,5 µm or less.

Degreasing followed by light alkaline etching and acid desmutting with rinsing after each stage.

A.3.2.3 Anodizing

Bath composition:

free sulfuric acid concentration:	(180 ± 2) g/l
aluminium concentration:	5 g/l to 10 g/l
rest:	deionized water

Anodizing conditions:

temperature:	(20 ± 0,5) °C
current density:	(1,5 ± 0,2) A/dm^2
air agitation:	strong
anodizing time:	(50 ± 2) min
coating thickness:	22 µm to 23 µm

No more than 10 standard specimens shall be anodized in a single batch. The volume of the anodizing solution shall not be less than 10 litres per dm^2 of surface treated.

In order to identify appropriate anodizing conditions, preliminary anodizing should be used to assess the uniformity of the coating thickness on a test specimen. It is important to confirm the uniformity of the coating thickness of standard specimens not only within the test area but also over adjacent areas. The variation in coating thickness shall not be more than ±1 µm.

A.3.2.4 Rinsing

Stage 1 rinsing:

solution:	pH 1,5 to 2,0
time:	1 min to 3 min
agitation:	strong

Stage 2 rinsing:

solution:	deionized water
time:	about 5 min
agitation:	strong

A.3.2.5 Colouring

Bath composition:

organic dye:	dye solution A of ISO 2143
rest:	deionized water

Dying conditions: