
**Anodizing of aluminium and its
alloys — Determination of breakdown
voltage and withstand voltage**

*Anodisation de l'aluminium et de ses alliages — Détermination de la
tension de claquage et de la tension de tenue*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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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*.

This third edition cancels and replaces the second edition (ISO 2376:2010), which has been technically revised. The main changes compared with the previous edition are as follows:

- the information of the test specimen has been added;
- a withstand voltage test has been added.

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.

Anodizing of aluminium and its alloys — Determination of breakdown voltage and withstand voltage

1 Scope

This document specifies test methods for the determination of the breakdown voltage and withstand voltage of anodic oxidation coatings on aluminium and its alloys, on flat or near-flat surfaces and on round wire. The methods are applicable to anodic oxidation coatings used primarily as electrical insulators.

The methods are not applicable to coatings in the vicinity of cut edges, the edges of holes, or sharp changes of angle on, for example, extruded shapes.

NOTE 1 Breakdown voltage and withstand voltage are affected by relative humidity.

NOTE 2 The methods described do not give satisfactory results for unsealed coatings because they are affected by the humidity in particular.

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 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 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/>

4 Principle

The electric voltage at which current first passes through an anodic oxidation coating is measured. These breakdown voltage and withstand voltage are a function of the dielectric characteristics and the insulation properties of the anodic oxidation coatings. The breakdown voltage and withstand voltage depend upon the thickness of the coating, as well as on many other factors, particularly the composition of the basis metal, its surface condition, the effectiveness of sealing, the dryness of the test specimen and the degree of ageing.

5 Apparatus

5.1 Power supply, from a suitable 50 Hz or 60 Hz source.

5.2 Transformer (AC), having an output with a waveform as nearly sinusoidal as possible, capable of producing the voltage required.

5.3 Voltage regulator, enabling the test voltage to be increased gradually from any point without interruption, and providing an essentially undistorted waveform so that the peak voltage is within the limit $\sqrt{2} \pm 5\%$ (i.e. 1,34 to 1,48) of the root-mean-square (r.m.s.) voltage.

5.4 Current limiting resistor, 0,5 M Ω , in series with secondary winding of the transformer and the test electrode probe (5.6).

5.5 Voltage-measuring device, which gives r.m.s. values, expressed in volts.

5.6 Electrode probe, made from conducting material, suitably insulated for handling purposes, free to move as required and adequately supported. The contact surface shall be spherical with a diameter of 3 mm to 8 mm and shall be maintained in a smooth, untarnished condition. The design of the probe shall be such that, when the spherical surface is placed on the surface of the anodized test specimen, the total force exerted on the coating is 0,5 N to 1,0 N (a probe of mass 50 g to 100 g is suitable).

5.7 Contact plate, for testing flat test specimens, having a smooth, bright, metallic surface, or a contact probe or clip which is capable of breaking through to the basis metal (7.1).

5.8 Twisting machine, for testing round wire, having two sets of jaws 400 mm apart, with one set of jaws fixed, while the other set is free to rotate. The jaws shall be mounted so as to prevent lateral movement of the jaws when the twisting operation is carried out (7.2).

6 Test specimen

6.1 Sampling

The test specimen shall be taken from a significant surface of the product, where the anodic oxidation coating formed thereon needs to satisfy the quality adapted to the application of the product. The test specimen shall not be taken from the edges for possible distortion and/or non-uniformity.

Where it is impossible to test the product itself, a test specimen which is representative of the product may be used. In this case, the test specimen used shall be made from the same material and prepared under the same conditions of finishing as those used for the preparation of the product. The aluminium alloy, the manufacturing conditions (kind and temper of the material), and the surface condition before treatment shall be the same as those of the product. Pretreatment and anodizing shall be performed in the same bath and under the same conditions as the treatment of the product.

6.2 Treatment before testing

The test specimen shall be clean, free from dirt, stains and other foreign matters. Any deposits or stains shall be removed with a clean, soft cloth or similar material which is wetted by an appropriate organic solvent such as ethanol. Organic solvents which can corrode the test specimen or generate a protective film on the test specimen shall not be used.

6.3 Size

The standard size of the test specimen should be 100 mm in length by 100 mm in width. The test specimen of a different size may be used as agreed between the customer and the anodizer.