TECHNICAL SPECIFICATION

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Paints and varnishes — Coating systems for wind-turbine rotor blades —

Part 1: Minimum requirements and weathering

Peintures et vernis — Matériaux de revêtement pour pales de turbines éoliennes —

Partie 1: Exigences minimales et érosion

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 35, *Paints and varnishes,* Subcommittee SC 9, *General test methods for paints and varnishes*.

A list of all parts in the ISO 19392 series can be found on the ISO website.

Introduction

In the wind energy industry, coatings are applied to rotor blades surface to protect the glass fibre reinforced polymer composite substrate. Rain drops and hailstones can damage these coatings in such a way that individual layers come off or the whole coating delaminates from the substrate.

This document describes the minimum requirements and weathering of the coating system. Rain erosion can be simulated by means of high speed water jets or water droplets impinging on the specimen surface. ISO/TS 19392-2 describes a method which simulates rain erosion by accelerating one or more coated panels, attached to the end of rotating arms, through a simulated rain field at a constant rotational velocity. ISO/TS 19392-3 describes a method where a water jet or a series of water jets at a defined pressure hits the surface of the specimen.

Paints and varnishes — Coating systems for wind-turbine rotor blades —

Part 1: Minimum requirements and weathering

1 Scope

This document specifies minimum requirements and weathering for coating systems for wind-turbine rotor blades.

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 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 527-3, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets*

ISO 1513, *Paints and varnishes — Examination and preparation of test samples*

ISO 2813, *Paints and varnishes — Determination of gloss value at 20°, 60° and 85°*

ISO 4624, *Paints and varnishes — Pull-off test for adhesion*

ISO 4628-2, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering*

ISO 4628-4, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 4: Assessment of degree of cracking*

ISO 4892-3, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

ISO 6270-2, *Paints and varnishes — Determination of resistance to humidity — Part 2: Condensation (in-cabinet exposure with heated water reservoir)*

ISO 11664-4, *Colorimetry — Part 4: CIE 1976 L*a*b* Colour space*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

ISO 16474-2, *Paints and varnishes — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

ISO 16474-3, *Paints and varnishes — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

ISO/TS 19392-2, *Paints and varnishes — Coating systems for wind-turbine rotor blades — Part 2: Determination and evaluation of resistance to rain erosion using rotating arm*

ISO/TS 19392-3, *Paints and varnishes — Coating systems for wind-turbine rotor blades — Part 3: Determination and evaluation of resistance to rain erosion using water jet*

IEC 60068-2-14, *Environmental testing — Part 2-14: Tests — Test N: Change of temperature*

IEC 61215-2, *Terrestrial photovoltaic (PV) modules — Design qualification and type approval — Part 2: Test procedures*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
weathering
exposure of test specimens to all prevailing elements of the atmosphere

4 Requirements and test methods

The coating material shall meet the requirements given in Tables 1 to 5.

5 Sampling

Take a representative sample of the coating material in accordance with ISO 15528.

Examine and prepare the sample for testing, as described in ISO 1513.

6 Preparation of test specimen

Prepare the test specimen in accordance with the required test method (see Tables 1 to 5). The substrate shall be agreed between the interested parties.

7 Test methods

7.1 Initial test methods

Carry out the test methods, as specified in Table 1.

Table 1 — Initial test methods

Characteristic	Requirement	Test method
Adhesive strength fracture type	>5 MPa only cohesion fracture >7 MPa adhesion or cohesion fracture	ISO 4624
Gloss	< 30 GU[a]	ISO 2813 (60° geometry)
Rain erosion resistance	ISO/TS 19392–2 or ISO/TS 19392–3[b]	ISO/TS 19392–2 ISO/TS 19392–3

[a] Maximum requirements for initial gloss can vary depending on national requirements and/or regulations.

[b] Method to be agreed by interested parties.

7.2 Test methods after artificial weathering

Carry out the test methods specified in Table 3 after artificial weathering/UV ageing in accordance with one of the weathering methods specified in Table 2.

Table 2 — Weathering methods

Weathering procedure	Standard	Radiation source	Cycle periods	Exposure duration[b] h
Method 1a	ISO 16474-2 cycle A1 (BST control)	Xenon arc lamp with daylight filters	102 min dry 18 min spray	1 000
Method 1b	ISO 16474-2 cycle A4 (BPT control)	Xenon arc lamp with daylight filters	102 min dry 18 min spray	1 000
Method 2a	ISO 16474-3 cycle A1	Fluorescent UV lamps type 1A (UVA-340)	4h dry 4 h condensation	3 000
Method 2b	ISO 16474-3 cycle A2	Fluorescent UV lamps type 1A (UVA-340)	5 h dry 1 h spray	3 000
Method 2c	ISO 4892-3 cycle A2	Fluorescent UV lamps type 1A (UVA-340)	8 h dry 0,25 h spray 3,75 h condensation	3 000
Method 3[a]	ISO 16474-3 cycle C4	Fluorescent UV lamps type 2 (UVB-313)	4 h dry 4 h condensation	1 000

[a] UVB-313 (type 2) lamps have a spectral distribution of emitted radiation, which peaks near the 313 nm mercury line and they can emit radiation down to λ = 254 nm, which can initiate ageing processes that never occur in end-use environments.

[b] The exposure duration for each method is provided as a guideline.

If moisture ingress affects the coating along the edges and/or the substrate, the edge and/or the substrate should be sealed.

NOTE Due to different climatic conditions during the exposure to radiation the ageing results can be different. On the basis of these methods, no final conclusion can be drawn on the ageing behaviour of blade coatings in the field.

