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Paints and varnishes — Evaluation of sag resistance

Peintures et vernis — Évaluation de la résistance à la formation de festons

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 16862 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

Introduction

When a wet coat of paint is applied to an inclined surface, the coat will flow down the surface under its own weight with cohesive forces opposing this flow. The balance of rheological and gravitational forces will allow a certain wet-film thickness to be applied without this unwanted flow becoming objectionable. Flow down an inclined surface is normally unstable, particularly if the coat is of uneven thickness, and it is this instability that leads to unsightly sags and tears. For a vertical surface, the gravitational force per unit area of surface, i.e. the stress, is given by $h \times d \times g$, where h is the film thickness in micrometres, d is the density of the coat of paint in kilograms per cubic metre and g is the gravitational constant in metres per second squared. The cohesive force per unit area of the surface is given by $V \times \mathrm{d}\nu/\mathrm{d}l$, where V is the Newtonian viscosity in pascal seconds and $\mathrm{d}\nu/\mathrm{d}l$ is the shear rate in reciprocal seconds. This International Standard describes two methods for determining the maximum wet-film thickness of a coating which can be applied to a vertical surface without giving rise to sagging or similar phenomena. The first method is carried out on a small scale using sag index applicators and the second is a larger-scale, practical test.

Paints and varnishes — Evaluation of sag resistance

1 Scope

This International Standard describes test methods for evaluating the sag resistance (resistance to sagging) of paints, varnishes and similar coating materials (coatings) when applied to a substrate and held in a vertical position.

Evaluation of the sag resistance can be carried out after the coating has been applied as follows:

a) using a sag index applicator on a horizontally placed test panel which is afterwards put into a vertical position,

or

b) using a spray gun for application on a substrate in a vertical position.

NOTE Brush or roller application can also be used provided that an even coating is applied.

This International Standard is applicable to liquid coatings only.

2 Normative references

The following referenced documents are indispensable for the application 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 1513, *Paints and varnishes — Examination and preparation of samples for testing*

ISO 1514, *Paints and varnishes — Standard panels for testing*

ISO 1517, *Paints and varnishes — Surface-drying test — Ballotini method*

ISO 2808, *Paints and varnishes — Determination of film thickness*

ISO 2884-1, *Paints and varnishes — Determination of viscosity using rotary viscometers — Part 1: Cone-and-plate viscometer operated at a high rate of shear*

ISO 2884-2, *Paints and varnishes — Determination of viscosity using rotary viscometers — Part 2: Disc or ball viscometer operated at a specified speed*

ISO 3270, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing*

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

3 Terms and definitions

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

3.1

sag resistance

greatest wet-film thickness, in micrometres, of a coating, under specified conditions of application, for a specified substrate and under specified environmental conditions, for which the coating will not have a tendency to flow during the drying process when placed in an inclined position

NOTE 1 This flow is known as sagging.

NOTE 2 Surface appearances typical of sagging are generally characterized by runs, tear drops, curtains or sags.

4 Apparatus

4.1 Sag index applicator, with gaps of defined clearance as given in Annex A, for applying film stripes of appropriate thickness. Examples of sag index applicators are given in Annex A.

4.2 Spraying device, airless or air-assisted, for applying the coating.

4.3 Wet-film thickness gauge, with an appropriate range.

4.4 Stirrer.

5 Sampling

Take a representative sample of the product to be tested, as described in ISO 15528, and prepare the sample for testing, as described in ISO 1513.

6 Test panels

Use standard panels prepared in accordance with ISO 1514.

NOTE For the sag index applicator method, glass panels should preferably be used to provide a flat surface over which the applicator will lay down stripes of coating of even thickness. A sag index applicator will not run consistently over a curved substrate.

7 Procedure

7.1 Test conditions

Unless otherwise stipulated or agreed, carry out the test under standard conditions, i.e. a temperature of $(23 \pm 2)\ ^{\circ}C$ and a relative humidity of (50 ± 5) % in accordance with ISO 3270.

The film thickness of a coating material at which sag does not occur when applied in accordance with 7.2.3 and 7.3.3 might differ. The values obtained by these methods are dependent on shear-rate at application, and the temperature. Moisture-cure and water-thinnable coating materials are particularly influenced by the relative humidity. The sagging tendency of two-component coatings is additionally influenced by the period between mixing the components and application.

7.2 Using a sag index applicator

7.2.1 Principle

Two test panels are coated with the material under test and the sag index applicator is drawn across the panels. The panels are placed vertically and the thickest stripe which shows no sign of sagging is noted on each panel. The actual wet-film thickness of each stripe is measured on a third panel.

7.2.2 General

A pre-shear programme is essential for a drawdown sag test to duplicate the breakdown in structure that occurs when thixotropic paints are applied by brush or another practical application method. The procedure therefore includes the pre-shearing of paints just prior to application. The rate of rotation and time of stirring shall be agreed between interested parties.

NOTE 1 Examples of procedures for pre-shearing are given in ASTM D 4400, which is an equivalent method using an applicator blade.

The wet-film thickness obtained through application is, depending on viscosity, rheology and application speed, smaller than the gap depth of the applicator. For this reason, it is necessary to determine the actual wet-film thickness applied and record this along with the largest gap size which does not produces sagging.

NOTE 2 If the test is being carried out for quality control purposes as a pass/fail test, then measurement of actual wet-film thickness may not be necessary.

Select a sag index applicator which will lay down a range of wet-film thicknesses which includes that specified for the product being tested. It may be necessary to determine which range is most suitable by experiment.

NOTE 3 For example, for a thixotropic thick film material with a sag resistance of approximately 60 µm of wet film, a blade with a 450 µm maximum gap depth should be used. In the case of a polyurethane finishing paint with a flow time of approximately 60 s through a cup with a 4 mm orifice, in accordance with ISO 2431, and a sag resistance of 60 µm, a blade with a maximum depth of 150 µm will suffice.

Ensure that the test panels are clean and dry. If necessary, clean with a suitable solvent and wipe dry with clean tissue or lint-free cloth.

7.2.3 Application

Lay one test panel horizontally and secure it over a sheet of tissue paper on a firm surface.

Place the sag index applicator on one end of the horizontal test panel with the clearance gaps facing downwards.

Carry out the agreed pre-shear programme (see 7.2.2) and immediately pour sufficient coating material against the applicator near the edge with the clearance gaps, avoiding bubble formation. Ensure that there is sufficient paint to enable properly formed stripes to be drawn down over a length of at least 100 mm, with excess paint being carried to the end of the panel and on to the tissue underneath.

Using a guide as necessary, immediately draw the applicator through the wet paint at a constant speed and with firm downward pressure so that separate stripes of wet paint are cleanly formed. If stripes which are not straight or which do not have clearly defined edges are formed, discard the test panel and repeat the application on a fresh panel.

NOTE Examples of methods for the automated application of paint films are described in ASTM D 823.

Immediately place the test panel in a vertical position with the stripes horizontal and with the smallest film thickness at the top.

Repeat the application procedure on a second panel.