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Paints and varnishes - Evaluation of sag resistance

色漆和清漆 抗流挂性评定

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1 Scope

The standard specifies a method for evaluating the sag resistance of paints, varnishes and similar coating materials applied to a substrate and then held in the vertical position.

Sag resistance may be evaluated after the coating has been applied in either of two ways: by drawing a graduated sag applicator over a test panel lying flat and then standing the panel vertically, or by spraying the coating onto a substrate already placed in the vertical position.

A note adds that brush application or roller application can also be used if they are able to form an even coating.

The standard applies only to liquid coatings.

3 Terms and definitions

3.1 Sag resistance: under the specified application conditions, the specified substrate and the specified ambient conditions, the greatest wet film thickness, expressed in micrometres, at which a panel placed at an angle shows no tendency to flow during drying.

Note 1 states that this flow is called sagging.

Note 2 states that the typical appearance of sagging generally takes the form of runs, tears, curtains and draping.

4 Apparatus

4.1 Graduated sag applicator: in order to obtain strips of coating of suitable thickness, the applicator has grooves of specified gap depth as given in Annex A; the graduated sag applicator conforms to the provisions of Annex A.

4.2 Spray unit: according to the needs of the coating application, an airless spray unit or an air spray unit may be chosen.

4.3 Wet film thickness gauge: of a suitable range.

4.4 Stirrer.

5 Sampling

A representative sample of the product under test is taken according to ISO 15528.

The test sample is examined and prepared according to ISO 1513.

6 Test panels

Standard test panels are treated according to ISO 1514.

A note adds that for the measurement method using the graduated sag applicator it is best to use glass panels, because glass gives a flat surface on which the applicator can draw strips of even thickness, whereas on a curved substrate the drawing action of the applicator is inconsistent from one end to the other.

7 Procedure

7.1 Test conditions: unless otherwise specified or agreed, the test is carried out under the standard conditions of ISO 3270, a temperature of $(23 \pm 2) ^\circ\text{C}$ and a relative humidity of $(50 \pm 5) \%$. The thickness at which no sagging occurs may differ between application by 7.2.3 and application by 7.3.3, because the sag values obtained by these methods depend on the shear rate and the temperature at the moment of application. Relative humidity has a particularly large effect on moisture curing coatings and on water borne coatings. The sag tendency of a two component coating is also affected by the interval between mixing the components and applying the coating.

7.2.1 Principle of the applicator method: the coating under test is applied to two test panels and the sag applicator is drawn along the panel; the panels are placed vertically, the thickest strip of coating showing no trace of sagging is recorded for each panel, and the actual wet film thickness of each strip is measured on a third panel.

7.2.2 General: applying a thixotropic paint by brush or by another practical application method causes a change of structure; to reproduce this when the sag test is carried out by

the draw down method, a pre shearing step is necessary, so the procedure shall include a pre shearing of the coating before application, the rotational speed and the stirring time being agreed between the parties concerned. A note adds that ASTM D 4400 gives an example of a pre shearing procedure equivalent to the knife method used with the sag applicator. The wet film thickness obtained after drawing down depends on the viscosity, the rheology and the drawing speed of the coating, and is smaller than the gap depth of the applicator, so the actual wet film thickness at the moment of application has to be measured and the greatest gap depth and wet film thickness showing no sagging recorded. A further note adds that where the test is for quality control purposes and is expressed as pass or fail, the actual wet film thickness need not be measured. A graduated sag applicator shall be chosen that can draw down a range of wet film thicknesses including the thickness specified for the product under test, and it may be necessary to determine the most suitable range by trial. The test panels shall be clean and dry; where necessary they shall be washed with a suitable solvent and wiped dry with a clean paper towel or a lint free cloth.

7.2.3 Operation: the panel is laid horizontally and fixed to a sheet of paper placed on a firm surface; the graduated sag applicator is placed at one end of the horizontal panel with the gap notches facing downwards; the agreed pre shearing procedure of 7.2.2 is carried out and enough coating is immediately poured against the edge of the gap notches of the applicator, air bubbles being avoided; there shall be enough coating for the applicator to be drawn at least 100 mm and form suitable strips of paint film, the excess being scraped onto the lower end of the panel and onto the paper beneath. A guide plate is used where necessary and the applicator is drawn over the wet coating immediately at a steady speed and with steady downward pressure so as to form clearly separated wet strips; if the wet strips are not straight or have no clear edges, the panel is discarded and the application is repeated on a new panel. A note adds that ASTM D 823 gives examples of automatic film application. The panel is stood vertically at once, with the strips horizontal and the thinnest strip at the top. The application procedure is repeated on a second panel. On a third panel the application procedure is repeated, the pressure and the speed being kept constant and the panel being kept horizontal, and the wet film thickness at the centre of each strip is measured immediately as specified in ISO 2808. Air drying coatings are brought to the surface dry state of ISO 1517 under the conditions of 7.1. Stoving enamels are flashed off in a drying cabinet as specified in the manufacturer's instructions and then stoved at the agreed temperature; throughout drying the panels shall be kept vertical.

7.2.4 Assessment: where the coating is allowed to flash off, sag resistance is assessed by identifying the lowest, that is the thickest, strip on each panel that shows no sagging; the assessment is based only on the middle part of the applied coating, the beginning and the end of each strip, normally 10 mm, being disregarded because the film thickness there may not be uniform. The wet film thickness measurement is carried out on the third panel, the actual wet film thickness corresponding to the greatest gap depth of the sag applicator at which no sagging occurred being determined. A note adds that, because the rheology of

coatings differs, sagging can occur immediately after application or several minutes later, so enough time must be left between application and assessment to make sure that the coating will not sag afterwards.

7.3.1 Principle of the spray method: one test panel is placed vertically and the coating under test is sprayed on at an even thickness; a horizontal line is drawn across the panel and any trace of sagging is recorded after a given time; the test is repeated with the film thickness increased or decreased until the greatest film thickness showing no trace of sagging is obtained.

7.3.2 General: in spray application the thickness of the sag free film obtained depends on the application method, for example high pressure compressed air spraying, air assisted airless spraying or airless spraying without air assistance, and on the standard application viscosity; the manufacturer's instructions are consulted to determine the suitable nozzle and spray fan size for the coating under test. The test panel shall be the substrate panel actually common for the coating, or an agreed substrate, with a minimum size of 100 mm x 300 mm. Where necessary the coating may be adjusted to the application viscosity, the amount of thinner added being reported as a mass or volume fraction, see clause 10, item f), and the viscosity being determined by one of the parts of ISO 2884.

7.3.3 Operation: note 1 states that, since it is more difficult to obtain an even film thickness with a spray gun, the person spraying should have enough experience with the equipment. The panel is placed vertically and the coating is sprayed evenly onto it to the required wet film thickness. The uniformity of the wet film thickness is verified according to ISO 2808; any panel showing signs of uneven wet film thickness shall not be used for assessment. Immediately after the wet film thickness has been read, a fine horizontal line is drawn across the test panel about 150 mm from the top, avoiding the marks left by the wet film thickness measurement, the line cutting through the wet film and exposing the substrate; the nominal width of the scribed line is listed in the test report. Note 2 states that it is convenient to draw this line with the unimportant edge of a wet film thickness gauge, provided the gauge cannot be damaged, for example not on a blast cleaned panel. The wet film thickness above the horizontal scribed line is checked again at once and the reading recorded. Note 3 states that it is convenient to record the film thickness readings on the back of the panel, which reduces the chance of confusion when several panels are coated. The panel is removed from the spray area at once and the film is flashed off in the vertical position; traces of sagging are examined according to 7.3.4.

7.3.4 Assessment: the panel is examined for traces of sagging immediately after the horizontal line has been drawn and again after a suitable flash off time. A note states that, depending on the rheology of the coating, sagging may be observed almost immediately after application or only after a few minutes, and that once the coating is surface dry all the panels can be examined again. If the film thickness exceeds the sag resistance of the coating, the horizontal scribed line begins to fill in, to shift or to disappear completely, which