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QC methods to check UV coated (pre-finished) floors

Content:

1. Adhesion

There are several procedures to check the adhesion between lacquer film and substrate on the one hand and to check the adhesion between the different lacquer layers on the other hand.
Please find the three most common possibilities as follows:

a. Coin-test

The coin-test: you take a sharp edged coin between the forefinger and thumb, press firmly on the lacquer surface and pull with constant pressure across the film. In the case of bad adhesion between film and surface, the film will dissolve, scratches will occur and there will be a typical stress whitening. This procedure is the simplest method for checking the adhesion. Only expertised personal will be able to determine the quality of the surface. The quality is based on a combination of variables (sharpness of edges, coin angle, pressure, etc.) and is therefore indefinable. As a result, norms are not possible.

Fig. 1: Surface before coin-test

Fig. 2: Surface with bad adhesion after coin-test

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b. Hamberger Planer

Hamberger Industriewerke has developed a testing device called the "Hamberger Planer" (Fig. 3) which can be used to conduct a coin test under certain defined conditions.

A piece of metal with a coin-like edge is pushed across the covered surface at a pre-definable pressure. The test result is the force applied until the appearance of first white marks. It is measured in Newton.

Fig. 3: The Hamberger Planer

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c. Grid cut According to DIN EN ISO 2409

The adhesive properties of the varnish film to the substrate and to itself is tested using a single or multiple blade cutter. As shown (Image 4), the blade is used to make a cross-cut on the test specimen offset by 90°. This produces a kind of chessboard pattern. The blades must cut through the varnish film. After cutting, any loose parts are removed from the surface with a brush. An initial inspection is carried out. Afterwards, an adhesion test is carried out with a defined adhesive tape. The tape is pressed onto the lattice with force before being pulled off at an even speed (between 0.5 – 1 second).

The surface is rated according to the Table, as follows:

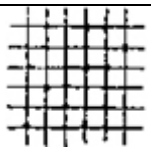
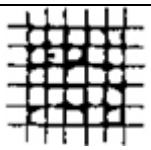
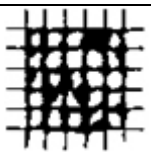
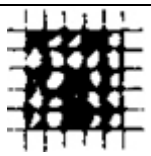
Grid Cut Classification	Description	Appearance of surface in area of grid-cut where flaking has occurred (example is for six parallel cuts)
0	The edges of the cuts are completely smooth, none of the lattice squares is detached.	-
1	Small flakes of coating have detached at the intersections of the cuts. The area affected is not significantly greater than 5% of the cross-cut area.	
2	The coating has flaked along the edges and/or the intersections of the cuts. Area of the cross-cut considerably greater than 5% but not significantly greater than 15% of the total cross-cut area.	
3	The coating has flaked along the edges of the cuts in wide strips partly/completely and/or partial/complete flaking on some of the squares. A cross-cut area considerably greater than 15% but not significantly greater than 35% is affected.	
4	The coating has flaked along the edges of the cuts in wide strips and/or partial/complete flaking on some of the squares. A cross-cut area considerably greater than 35% but not significantly greater than 65% is affected.	
5	Any flaking that cannot be classified under Category 4.	-

Fig. 4: Multiple blade cutter

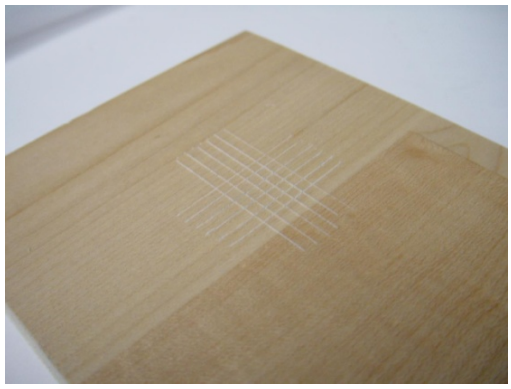


Fig. 5: Sample with grid cut

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2. Gloss value

According to ISO 2813, 60° geometry

Radiation from a light source is reflected off the surface of the floor at a defined angle (normally 60° for coated parquet surfaces) and measured by a sensor. The more glossy the surface, the less light gets reflected from its surface, and the lower the specular gloss. The specular gloss readings are too imprecise for very matt surfaces meaning that surfaces with identical gloss value may look considerably different. In the gloss value test it is therefore necessary to carry out a visual inspection of the test surfaces against a master sample.

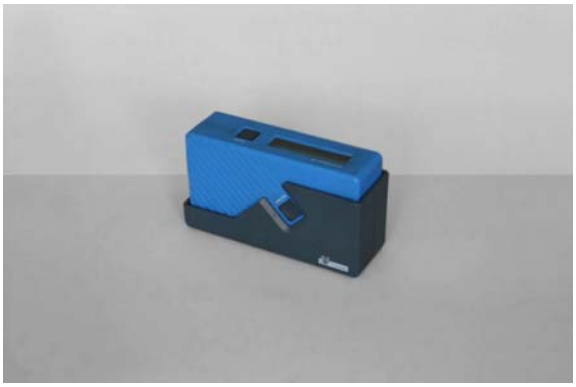

Fig. 6: Gloss value test device

3. Colour tones

Colour variations should be checked against the master sample. In case of stains, transparent systems or metallic lacquer, the colour tone depends on applied quantity, application method and substrate. Colour variations are possible even if colour quality remains constant. The master samples need to be stored under cover of darkness to avoid colour tone variations due to light exposure. Whilst manufacturing master samples with transparent finishing, one section on the surface of the raw wood should be taped and protected against the coating. This makes it possible to distinguish between changes of the wood colour and of the coating itself. Furthermore the colour should be checked using different types of light (day-, neon- and light bulb light). The release of the current production sample should be carried out by two persons. If you intend to coat bigger objects like furniture fronts, always use lacquer material of the same batch because a 100% adjustment of different batches is technically impossible.

4. Resistance to scratches / Mar-resistance

Resistance to fine scratches is tested by scratching the surface with steel wool, applying normal pressure.

Alternatively an abrasive sponge can be used. Scotch Brite 274 is the only current one that makes it possible to cause scratches on a UV lacquered surface. Since no test equipment has been defined for this kind of test, it can only provide subjective test results.

Fig. 7: Surface scratches on a UV surface with normal UV top coat

Fig. 8: Grey marks on a surface with anti-scratch UV top coat

Fig. 9: No marks on a UV surface with UV anti-scratch top coat

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5. Resistance to indentation

According to DIN EN 438 Part 2 – 25

The test specimen is tested during one revolution of a defined diamond point at a pre-defined pressure (Newton). Several scratch tests are carried out side by side at different levels of pressure during which the pressure on the surface is changed on a scale from high to low. With each revolution, the pressure on the specimen is adjusted to a different part of the surface.

The test result is the value in Newton at which an indentation on the surface is no longer apparent.

Fig. 10: Test device for measuring resistance to indentation

6. Impact test / Ball-fall test

According to DIN EN 438 Part 2 – 12

In the impact test a metal ball applies a force to a varnished surface at a pre-defined spring tension/weight. The ball leaves behind a dent which is largely dependent on the hardness of wooden substrate. The test measures the weight at which the first continuous cracks appear in the varnish in the form of concentric rings along the edge of the dent. These cracks are marked with a felt-tip pen before being wiped off with solvent. The cracks in the varnish are made visible by the residue from the pen at the point of impact. The drop-weight test is thus a method of measuring the elasticity of a varnish film. Due to the qualities of different woods, it only makes sense to compare measurements for one and the same wooden substrate.

The test result is the value in Newton at which no residue of pen colour remains after having it wiped off with solvent.

Fig. 11: Impact test device

Fig. 12: Impact test device

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7. Layer thickness

The thickness of the layer of the applied coating film is measured under a microscope using a narrow disk from the test surface.

This method always returns a relatively precise reading in µm. Non-destructive test methods also exist for determining the thickness of the film layer. It has been shown in practice however that the results from these tests can be extremely imprecise, especially UV varnish add-ons based on current methods.

Fig. 13: A microscope

8. Heat resistance (Cigarette test)

Corresponding to DIN 68861 Part 6

3 cigarettes from different brands are used for this test. The first 10mm of each cigarette is smoked before being placed on the coated surface. The cigarette is removed from the test surface once the cigarette has burned down a further 40mm.

If any changes to the surface arise, either in its colour or other visible changes, the surface will need to be cleaned as thoroughly as possible with a defined cleaning agent.

Rating of the test results from the cigarette test:

6A No change
6B Change in gloss visible to naked eye
6C Gloss and/or colour change
6D Colour change
6E Destroyed

Fig. 14: Cigarette test

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9. Chemical resistance

According to EN 13442

In the following table you find a list of the chemicals used to measure chemical resistance in accordance with EN 13442.

Our UV varnishes for prefinished parquet floors are passing the EN 13442. All chemicals could be removed with no trace after being left on the surface.

Chemicals/substances	Beginning temperature of substances (± 5) °C	Duration
Destill. water	20	(24 ± 1) h
Cleaning agent (def. mixture)	20	(24 ± 1) h
Aceton, min. 95 %	20	(120 ± 10) s
Ethanol, clean, not denaturated, 50 % in destill. water	20	(24 ± 1) h
Simple red vine, alcohol content 10 % to 12 % vol.	20	(24 ± 1) h
Red vine vinegar, acetic acid solution 3 % to 5 % vol.	20	(24 ± 1) h
Olive oil	20	(24 ± 1) h
Milk, 3 % to 5 % fat	80	(24 ± 1) h
Coffee, 40 g dehydrofrozen instant coffee per l cooking water	80	(24 ± 1) h
Black tea, 10 g tea leafs brewed with 1 l cooking water. Brewing time 5 min	80	(24 ± 1) h
10%ige, ammonia solution	20	(8 ± 1) h
Blue/black ink	20	(24 ± 1) h

Interpretation:

5: No visible changes (no damages).
4: Light changes in gloss and color, only visible when light sources are reflecting on or next to the marks to the eyes of the observer, or single just visible marks.
3: Light marks, visible from different directions, for example the visibility of nearly complete form of filter paper
2: Strong marks, but the structure of the surface is broadly unchanged.
1: Strong marks, the structure of surface has changed or the sealer is completely or partially worn off, or the filter paper inheres to the surface.

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10. Abrasion resistance

Our abrasion resistance tests use the Taber Abraser.

Fig. 15: Taber Abraser dual-head unit

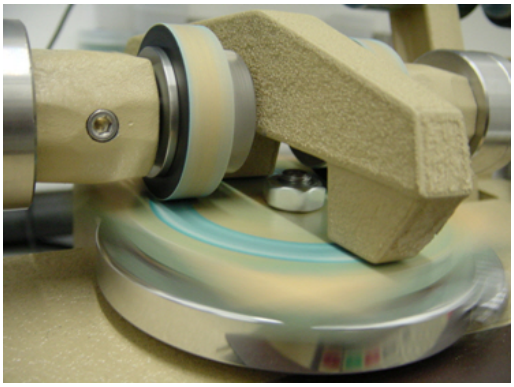

Fig. 16: The Taber Abraser in action

a) Test according to DIN 68861 Part 2, S33 strips of sandpaper, 500g weight. Strips of sandpaper with defined grit are attached to the abrading wheels. The pressure applied to the test surface is 5.5 ± 0.2 Newton.

The strips are replaced every 500 revolutions. The test ends as soon as the first bald patch of wood becomes visible. This point is known as the "Initial Point" ("IP").

b) Test according to ASTM D 4060, CS17 wheels, 1000g weight. Specially defined abrading wheels are used for this test. The test ends as soon as the first bald patch of wood becomes visible.

c) Test according to SIS 92 35 09, S39 with leather wheels and special sand S41 which is fed by an additional device, the 'grit feeder', with a weight of 1000g.

This test uses defined wheels with a leather coating together with a defined (quantity of) sand as the abrasive. The grit feeder spreads an even amount of the standard sand in front of the first leather wheel. The sand thus ends up beneath the leather wheels which pressed onto the test specimen with a weight of 1000g. Afterwards the sand is fully removed with a suction tube positioned after the second leather wheel. This ensures that an identical amount of sand is on the surface when the next revolution is made.

The test ends as soon as the first bald patch of wood becomes visible.

Fig. 17: Taber Abraser with falling sand device

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11. Pendulum hardness test

According to ISO 1522

The test is conducted using a special device on a glass plate based on the König test method which is used to measure the oscillation damping of the film of varnish. The oscillations are recorded by a photo sensor. The harder the coating film the greater the number of oscillations as the pendulum will be slowed down by a softer coating.

Materials with high resistance, e.g. Miraphen® UV varnishes achieve more than 100 oscillations.

Fig. 18: Pendulum hardness tester

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