

Attachment 1 –

COATING TECHNOLOGY HANDBOOK,

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Attachment 2 –

Review of the UK Environmental Protection Act,

Provided by Andy Hills, London Metropolitan University

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COATING TECHNOLOGY HANDBOOK

ANDREAS NTAKOULIAS
CHEMIST

Introduction.

Dear friends – painters,

Thank you for choosing our ERLAC products to finish your furniture.

“ER-LAC G.D. KOUTLIS S.A. is one of the major GREEK varnishes, sealers and stain manufacturing INDUSTRIES, exporting its products to many countries around the world.

ER-LAC managed to achieve, using various methods and systems for producing high quality products, excellent results due to scientific and technical stuff. With the appropriate information and guidance by the sales department ER-LAC was able to ensure:

QUALITY - ENDURANCE - ECONOMY – PRESENTATION.

But it is clear that in order to have the desired results, you must follow the instructions and specifications of the products you use.

This form is intended to propose a working method for all the production stages, so that your furniture might have the best protection, strength and beauty.

Ten basic rules to achieve a perfect result for your furniture.

1. The dye cabin should always be clean and the ground wet, before and during painting (painting outside the cabin).
2. The sanding should be according to the wood and the grain.
3. Constant control of the compressor (water-oil-dust) and air pressure.
4. Compliance with the standards for catalysis and dissolution of the product.
5. Prepare the product A + B + solvent, when you are ready to paint and not before. Like this we ensure the right liquidity.
6. Avoid painting with a wood humidity less than 8 degrees and more than 12 degrees.
7. Clean the surfaces with a clean cloth before spraying undercoats and before spraying final coats.
8. Spray always with crossed arms and hold the appropriate times.
9. Ideal temperature for painting is 22 to 25⁰ C.
10. A highly protective mask is necessary.

We wish you success in your daily work.

Personal Protection

Description

Choose the appropriate means of individual protection against various pollutants.

Personnel

1. Wear gloves, goggles and appropriate breathing devices when sanding, degreasing or painting.
2. Use clean clothes for degreasing.
3. Clean with air the surface and check after degreasing for small defects.
4. Do not use substances such as hair or hand creams while working.

Workplace

1. Keep the workplace always clean
2. Allow the furniture to have room temperature
3. Avoid leaving open cans of hardeners and solvents into the spray booth.

Equipment

1. Make sure that the compressors provide clean and filtered air.
2. Make sure that in the spray booth circulates filtered fresh air.
3. Regularly check the special filters and replace them when needed
4. Allow enough fresh air first on new operating lines and air hoses before use
5. Leave the cleaning materials etc.. outside the spray booth.



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CHAPTER 1

BASIC CONCEPTS – PROPERTIES OF VARNISHES



1. SOLIDS

DEFINITION: *Is the solid remains of an undercoat, topcoat varnish or lacquer after the complete evaporation of liquid components (solvents and any liquid components it contains).*

Specifically in varnishes it is the % of solid content, like dry resins, matting agents and fillers.

Out of this definition we understand that what is left on the flesh of the wood after drying are the solid remains. Higher solid substrate of a Sealer, lesser product needed to fill the pores of the wood from hand to hand.

BASIC RULES. Less solid percentage substrate of the Sealer, more hands are needed to fill the pores in the surface of the wood.

2.VISCOSITY

DEFINITION: *A physical property of fluids that determines the flow. In particular it is the time required to pass a certain volume of liquid through a hole with predetermined caliber.*

In particular in varnishes with the term viscosity, we mean the time required to pass 100ml material through a hole size as specified by the international standards ASTM. The viscosity is measured in seconds at a constant temperature and determines the liquidity of the material.

FOR EXAMPLE.

When we say that a material has a viscosity of 16 seconds we mean that 100 ml of this material took 16 seconds at 25 °C to go through a bowl DIN N04 or DIN N06.

Referring to cup DIN N04 or DIN N06 we must define that they have a different diameter hole and therefore we should be more specific when talking about the time of 16 seconds.

This would be more correct to present that time as follows:

Visc. = 16'' / 25° C / DIN 4.

The viscosity is influenced by temperature. That's why we measure the viscosity with a stable temperature of 25° C. All other measurements at different temperatures should be noted. If the viscosity is measured at different temperatures the results have to be recalculated according the temperature of 25 °C using the Matrix found in Annex 1.

During the winter, where temperatures are below 25 °C the viscosity is increased (the product is more thick). In contrary during the summer it is reduced (the product is thinner). For example, honey is thinner in the summer and during the winter it has the intention to become solid.

3. THINNING

DEFINITION: *By this we mean the rate of thinning solvent required to be added in order to lower the viscosity of the material.*

Saying that a material has the need of 20% thinning in order to be applied, we mean that if we have 1 kg of mixture A + B we must add 200 grams of solvent (thinner).

The reasons for a material to be diluted are:

1. For easier passage of the material through the nozzle of the gun. Example: A material with a viscosity of 20"/ 25⁰ C / DIN 4 passes with more difficulty through a 1,4 mm nozzle than a material with a viscosity of 15"/ 25⁰ C / DIN 4 because it is much thicker.
2. To easy up the leveling (spreading). If the dilution is less than the recommended rate of the material it will not level properly and it may create various problems listed below (see Orange peel, Boiling - Louse, Blur - Whitening).

If the dilution is more than the recommended rate for the material, than we have a reduction of the solid substrate and we need more application hands to fill the wood, in case we apply final coating we will have a reduction of the glossiness.

FOR EXAMPLE.

MIXTURE A: FINISH diluted 10% with Thinner 302

MIXTURE B: FINISH diluted 20% with Thinner 302

The mixture B has a higher POT LIFE from the mixture A but less solids.

MIXTURE FINISH UNDILUTED. 42% solids

MIXTURE FINISH DILUTED 10% 302. 38,18% solids

MIXTURE FINISH DILUTED 20% 302. 35% solids.

4. THINNERS.

DEFINITION: *The means by which the thinning is achieved.*

Solvents are used to ensure a uniformed evaporation of material at low or high temperatures, which affects leveling.

Solvents are divided into the following categories:

A. NITRO THINNERS.

B. POLYURETHANE THINNERS.

C. SPECIAL THINNERS.

A. Nitro solvents - thinners are used only for the dilution of sealers - fillers, final varnishes and generally for all nitro products (based on nitrocellulose). Under no circumstances should we use nitro solvents to thin polyurethane products (**2 components**) for those that adversely affect the hardener (because they contain alcohol). If a Nitro thinner is used in PU 2c products it will create issues presented below. (See Blur - whitewashing).

B. The polyurethane solvents are used for dilution of nitro products and also for dilution of all products of 2 component polyurethane based.

C. Special solvents used only in specific product categories such ENAMELS - OVEN COLORS - EPOXY PAINTS.

All types of solvents are divided into SLOW and FAST. In the same temperature a slow solvent will evaporate at a slower rate than a fast one. At high temperatures always use slow solvents in order to help the leveling and avoid problems such as: orange peel, boiling etc..

How much thinner will be used, depends only on the viscosity of the undiluted mixture and the specifications given by the company for the product.

5. POT LIFE

DEFINITION: *It's the time to double the viscosity of a mixture. It refers only to products of two components.*

Saying that a product has POT LIFE 4 hours mean that within 4 hours we will have doubled its original viscosity. Usually the mixture can be used within that time even if you need to add more thinner in order to restore the desired viscosity for the spray gun. If this happens at the topcoats will reduce the sheen, and if happens at the undercoats and surfacers will reduce the fill and the cover by the reduction of the solids.

The pot life of the mixture is different for each product (see product specifications).

IMPORTANT. The increase in viscosity of a product causes us to dilute more to restore it to the desired viscosity for the spray gun, which reduces the gloss. For this reason at the final varnishes and lacquers if we need the specified gloss of the product should use the mixture as soon as possible before changing the viscosity.

When you pass the pot life time the mixture turns to gel and must necessarily be thrown.

AFFECTING FACTORS

1. The temperature. Higher temperatures reduce the pot life.
2. The dilution ratio. Increasing the dilution increases, the pot life.
3. By incorrect mixing ratio A + B component. If the hardener is mixed with the A component in larger quantity, the mixture will have smaller pot life.

IMPORTANT. There is the impression that diluting with slow thinners will be increase the pot life. **THIS IS WRONG.** In fact using slow thinners has a little influence - almost none - at the pot life.

6. DUST FREE

DEFINITION: *It is the time it takes for the top varnish surface to dry.*

After that time, the dust does not stick on the surface. If dust falls into the surface it can be removed with a simple air blow. (WARNING NO WIPING).

HOW TO TEST THE DUST FREE: When sticking our finger on the surface it doesn't leave fingerprint.

IMPORTANT. During the dust free time we can't move the surface because it might get injured.

AFFECTING FACTORS

1. Dust free can be affected from the speed of drying.
 2. From the type of the thinner used.
 3. From the temperature.
 4. From the film thickness.
-

7. TOUCH DRY.

DEFINITION: *It is the time required so that your hand does not leave a finger trace over the surface.*

In this case we cannot sand because the film has not dried in depth. If we try to sand, the sanding paper will get stuffy and there is a risk to spoil the surface.

HOW TO DETERMINE IF IT THE SURFACE IS TOUCH DRY: Touching the surface with our fingers does not leave the slightest mark.

During the touch dry time, we can touch the furniture in order to carry them safely without being injured by our hands.

The affecting factors are the same with the dust free factors.

8. DRY IN DEPTH.

DEFINITION: *It is the time needed for the film to dry inside.*

In this case we can sand, pack or stack the furniture and also we can turn it without being injured.

The effecting factors are the same with the dust free factors.

9. ELASTICITY.

There are two types of elasticity: **a. Elasticity of liquid film and**

b. Elasticity of dry film

A. Elasticity of liquid film.

DEFINITION: *It is the ability of the material (substrate or final varnish) not to brake during the polymerization by a sudden drop of temperature.*

B. Elasticity of dry film

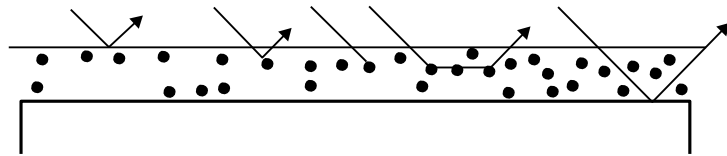
DEFINITION: *It is the ability of a substrate or a varnish to adopt easily the physical or mechanical deformation of the wooden surface without breaking.*

PHYSICAL DEFORMATIONS: Are contraction and expansion of the wooden surface from sudden temperature changes.

MECHANICAL DEFORMATIONS: Are the deformations of any surface from scratches, bending, pressing, etc.

10. GLOSS.

DEFINITION: *Gloss is the percentage of light reflection.*



1° arrow = surface reflection

3° arrow = absorbing of the pigment

5° arrow = reflection of the stain.

2° arrow = reflection of the pigment

4° arrow = reflection of the pigment

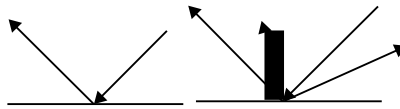
The higher the reflectance percentage of a surface the shinier it is. A shiny surface reflects more the light beams than a satin surface.

AFFECTING FACTORS

1. On how well the surface of the wood is filled with paint.
2. On the strength of the substrate in the solvents used.
3. From the thickness of the film.
4. From the dilution ratio.
5. From the type of solvent used in combination with the temperature.
6. From the nature of the prescription of the varnish.

BASIC RULES

1. Better filled surfaces give higher gloss.
2. More durable substrates within solvents, the more sheen gives the final varnish.
3. A thicker final film of the varnish, the greater it will shine.
4. If we dilute more, we will have less quantity of varnish left in the wooden surface, so we will have much less gloss.
5. Slower to dry, more gloss we have.



GLOSS SURFACE MAT SURFACE

NOTE: Over the time the gloss on all surfaces decreases. The quantity of the material fallen onto the surface determines the reduction of shine. More material means more shine lasting.

SURFACE	FILM THICKNESS	GLOSS IN 24 HOURS	GLOSS IN 1 MONTH	GLOSS IN 4 MONTHS	GLOSS IN 8 MONTHS
A	100µm (1)	60%	59%	58%	57%
B	60µm (2)	60%	56%	53%	48%

A) 1 single + 1 crisscross layer with 20% dilution

B) 1 single layer with 20% dilution

Some time is usually took 12 months for the sheen of the surface to stabilized, but there is no way equals the area A with B.

11. TRANSPARENCY

DEFINITION: *Transparency is the property of the material (substrate - final varnish) which allows us to see as clean as possible the natural beauty of the wood or the color of the stain.*

The amount of transparency is higher at dark shades. One more quick and easy way to check the different transparency between two materials, is to apply the same amount from each on one piece of glass and after to check the clarity when we are looking through it.

AFFECTING FACTORS

1. The total thickness of the films. Applying multiple layers reduces the transparency.
2. The production of the varnish. The transparency of a varnish is a selection of the manufacturing company, depending on the use of materials and customer requirements. Many companies select opaque substrates in order to trick the end user, and to make him think that less hands fill more the pore of the wood. When the substrate is transparent (shiny) then the pore of the wood due to the reflection seems empty, although it is not. The more transparent

the undercoat is, the more it reflects the natural beauty of wood or the stain. Expensive and stylish furniture require transparent materials.

3. The shine. Low shine affect the transparency of the film. As we descend to shine so un-transparent the film is. So at low shines we should select a transparent varnish.

12. HARDNESS.

DEFINITION: *Hardness is the ability of the final varnish to resist scratching.*

HOW TO DETERMINE THE HARDNESS OF FINAL VARNISHES:

If we scrub with our fingernail the dry surface and it doesn't streaks this means that the varnish is hard, so it can resist the wiping with a dust cloth.

Depending on: The nature of the formula of the final varnish?

NOTE. A very hard varnish is not elastic. It cannot be scratch but if the furniture falls during transportation, it could be broken. So there must always be a perfect balance between hardness and elasticity.

13. TOUCH – FEEL.

DEFINITION: *Touch feel is the property of the varnish which allows our hands when sliding on the film, to have a velvety and silky feeling.*

AFFECTED FROM:

1. Mainly from the nature of the formula.
 2. From the concentration of rubbish, dust or fog coating from the spray gun on the surface.
-

14. SANDING.

DEFINITION: *It is the process by which either we prepare the wooden surface to accept the undercoat or the undercoat in to receive the final varnish.*

Why are we sanding the wooden surface?

1. In order to smoothen the mountains and valleys of the wooden surface (see image below)
2. In order to allow the stain to be absorbed uniformly from the wood, leaving no spots.
3. In order to remove any damages or defects from the surface to be stained.

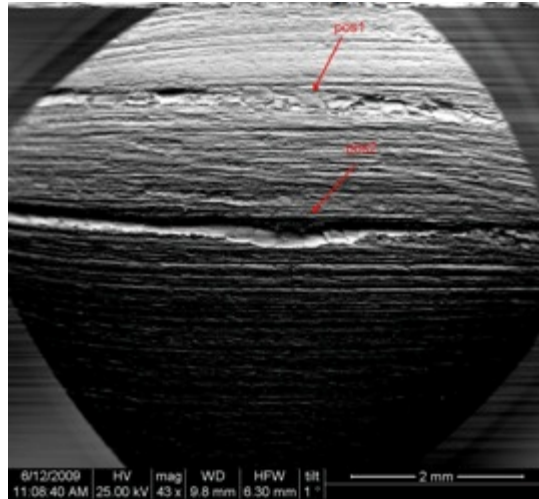


image from microscope

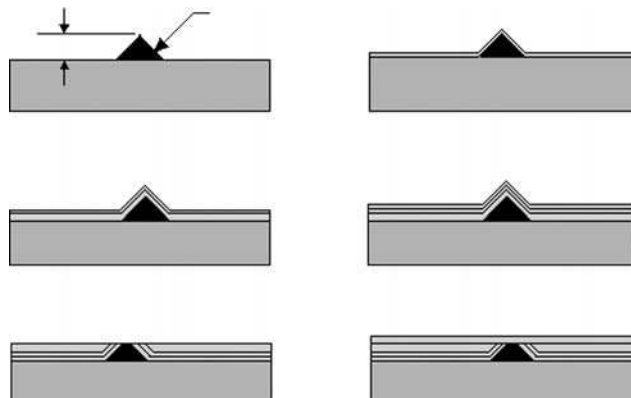


Fig 1

In the Fig 1 above we have a raw surface and we fill this surface with 1 – 2 – 3 layers of undercoat. Finally we have a sanded surface.

Why the undercoat must be sanded?

1. To create adhesion between the undercoat and the final varnish. Rubbing creates invisible scratches - grooves on the surface of the undercoat which are necessary for adhesion.

2. For a good result of careful hand work.

The rub is usually made with sanding machines using sanding papers.

Grain size and the right choice

All abrasives are measured or divided into categories based on size, type of paper, type and quantity of grain (Emery).

The choice of grain is important when we sanding because:

1. The sanding with fine grain tends to polish the wood and rejects the color and paint, with the risk of detachment
2. The grinding, with very coarse grain tends to generate very deep grooves, which are high absorbent making staining easy.

Usually used grains

Leveling:	Chipboard - wood - massif Grains: P40 - P 50 - P 60 - P80 - P100
Grinding:	Solid wood - veneer Grains: P100 - P120 - P150
Polishing:	Colors similar quantity and composition Grains: P240 - P280 - P320
Scrubbing:	Finishes in accordance with quality Grains: P600 - P800 - P1000

Because P120 from one manufacture isn't equivalent of another P120, you will have to follow the comparison table.

SIA	FESTO	3M	3M	3M
1919	BM	245-255	210-212	618-622
1934	NORTON	RANGE	RANGE	RANGE
P40	P4	P80	P60	P40
P60	P6	P100	P80	P60
P80	P8	P120	P100	P80
P100	P10	P150	P120	P100
P120	P12	P180-220	P150-180	P120
P150	P150-180	P240	P220	P150
P180	P180-220	P280	P240	P180
P220	P24	P320	P280	P220
P240	P28	P360	P320	P240
P280	P32	P400	P360	P280
P320	P36	P500	P400	P320

P400	P40	P600	***	P400
P500	**	***	***	***

15. RETOUCH.

DEFINITION: *Retouch is the process we use to correct minor imperfections encountered during the application of paint or the topcoat. Usually retouch is done using colored varnish (mixing anilines with the topcoat).*

Example 1. If during the sanding of the undercoat we damage by mistake the wood, then we should do the following. Apply final polish regularly across the surface - even to the point that is damaged - and then locally, at that point, to apply colored varnish.

Example 2. If the final shade of painted surface does not satisfy us and we want a darker look, then we can correct with colored varnish, called retouch.

16. SPECIFIC PROPERTIES OF VARNISH

A. Thixotropic

DEFINITION: *Thixotropic is the property of the fluid to resisting the physical flow. Specifically thixotropic fluids develop inner resources allowing them to have a more compact form, this is slowing the flow when applied on vertical surfaces.*

USE: Mainly applied to vertical surfaces such as chairs, buffets, boxes, tables, etc.

BENEFITS:

1. Applied in cases where common varnishes can not to be used due to tearing.
2. Also applied to horizontal surfaces with an increased dilution, allowing them to accept more layers than they would, in comparison with a common varnish in order to achieve the same film thickness.

Disadvantages: Due to the nature of the material an orange peel effect might occur above 30% gloss.