COATING PLANTS

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◊ FLOW-COATING PRESERVATION PLANTS

PRESERVATION PROCEDURES

Work with at least 125 litres of material, since this reduces product stress and preserves flow and colour, especially in summer.

Viscosity control

All products on the market, for tank or flow-coating application, after product stress tend to lose part of the cosolvents and water. This increases viscosity, with consequent flow and colour issues. Therefore it is very important to regularly check product viscosity and keep it constant by adding tap water, to achieve viscosity of DIN 2 at 20°C for products less than or equal to 50 s. Measure viscosity using a DIN flow cup with a 2 mm hole (easily found in specialised shops) and a stopwatch. The term viscosity is improperly used, since what you are really measuring is the time taken for the contents of the cup (100 ml of product) to flow out through the hole made in the bottom (for DIN 2 the hole size is 2 mm).

Another, simpler, faster way to check product viscosity is to introduce water into the tank depending on the ambient conditions. For example, the following table is used, which may have to be adapted for your plant.

Litres of water/hour		Ambient humidity (%)				
		40	50	60	70	80
Ambient temperature (°C)	10	1,750	1,250	0,750	0,250	
	15	2,000	1,500	1,000	0,500	
	20	2,250	1,750	1,250	0,750	0,250
	25	2,500	2,000	1,500	1,000	0,500
	30	2,750	2,250	1,750	1,250	0,750
	35	3,000	2,500	2,000	1,500	1,000

Litres of water which for each hour of operation must be added to every 100 litres of protective wood stain, depending on the ambient conditions (temperature and humidity).

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Only use drinking water to dilute the product in the tank. If well water is used, it should preferably be collected in a tank and treated at least 24 hours before use with a suitable bactericidal product.

Foam control

If necessary, add 100 cm^3 (for every 100 litres of protective wood stain) of OECE ***862-11*** anti foam. If the product tends to form a lot of foam, repeat every 20 minutes.

Flow control

At the first sign of flow problems, even after adding water and with viscosity within the specifications, add 2 litres of OECE ***86V-81*** corrector (for every 100 litres of protective wood stain). In that case, the ***86V-81*** also acts as a thinner.

Cleaning the plant

It is known that after a long period in the tank, particularly during the summer, water-based products may be at risk of decay due to the bacteria, yeasts and fungi found in the air and wood. That phenomenon is easy to identify, since it causes unpleasant odours and increases the viscosity of the product in the tank. There is no cure for this. Prevention is key.

You must regularly (at least monthly) clean the tank or flow-coater thoroughly using a solution of 2% OECE ***89G-03*** in water. This also has a disinfecting action. Allow the solution to circulate in the plant for at least 15 minutes and leave it in the tank all night, ensuring that pipes also remain full of the sanitising product. After the treatment, thoroughly rinse the plants with mains water. Repeat at least once a week for one month to eliminate serious biological infestations.

If the flow-coater does not have an internal filter, you must filter the product at least once a week (e.g.: on a Friday). Always filter the product before leaving the plant unused for a long period (for example, over the summer holidays). As a precaution, if the product must remain in the tank or flow-coating machine for a long time, add 0.1% of OECE ***89G-03***. Close the tank with a lid to prevent bacteria from getting into the product.

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Sometimes applying water-based protective wood stains using a flow-coating plant results in inadequate product flow on joinery, with the formation of dark patches or unsightly streaks. The experiences of many users have revealed that this may be caused by several factors and in most cases has a variety of external causes. Therefore, to have some sort of guarantee of achieving good protective stain application, it is important to carefully control the most widespread causes of defects encountered at the application stage.

To correctly apply protective wood stain on joinery, you must take into account the following parameters, which could prevent correct flow of the protective wood stain on the bare wood.

<u>Joinery position and angle</u>

Very often incorrect frame positioning or angling on the aerial chain is responsible for poor protective wood stain flow. In zones with a low gradient, it does not drip properly, causing build-ups resulting in very unattractive patches.

Therefore, for correct application of a protective wood stain, joinery must be positioned in such a way that the longest parts are always vertical and the angle is appropriate (approx. 20-25°).

<u>Drying tunnel size</u>

It is extremely important that the drying tunnel (where present) is of the correct size. This prevents hot air from flowing directly onto the freshly impregnated workpiece while the product is still in the drip phase. It is important to ensure a drying time of at least 10–15 minutes at ambient temperature, during which the protective wood stain can flow correctly. The hot air rapidly dries the protective wood stain, preventing the resin from keeping the initial flow characteristics.

<u>Build-up of sawdust in the flow-coater tank</u>

The build-up of sawdust and/or dust from sanding in the flow-coater tank, which is inevitable even if articles are carefully dusted with compressed air, slows down the flow of protective wood stain, making the above-mentioned defects more likely. In these cases it is important to regularly filter the protective wood stain (at least once or twice a month), taking care to remove any residues from the tank.

<u>Drip holes</u>

Improved protective wood stain performance can be obtained by making drip holes at the build-up zones. At the zones where protective wood stain tends to pool (e.g.: corners), the wood has a lot of time to absorb the wood stain deep down, resulting in darkly coloured deep absorption zones (marks).

Naturally, it is important to keep drip holes open and clean, as they could become blocked during processing. It is also essential to select diameters appropriate for the article's dimensions.

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Build-up of foam in the flow-coater tank

For flow-coating application, especially on machines that mix and atomise the protective wood stain, there may be a build-up of foam in the protective wood stain, which is no longer able to dispose of it correctly, especially if not renewed with fresh product or if the machine operates for long periods.
That greatly hampers protective wood stain flow, also causing drips between horizontal members once drying has finished, resulting in ugly trickling. To avoid this problem, during processing (varying from one machine to another) add 0.01-0.05% of OECE ***862-11*** anti-foam for flow-coating, to reduce foam and encourage flow.

pH variation

During flow-coating, after a high level of product stress, there is considerable loss of water, glycols and basifying agents, with a negative effect on the main characteristics of a protective wood stain, such as flow and stability in the tank. That may cause major problems, above all in terms of appearance, which cannot be overcome simply by adding water or fresh product in the machine. In such cases, add 3–6% of OECE ***86V-81*** corrector which contains the correct dose of glycols, water and ammonia to restore the initial characteristics of the protective wood stain, including correct flow.

Product state of preservation

Water-based protective wood stain may be attacked by bacteria, resulting in the loss of its characteristics and even causing foul smells.
Take care not to leave the tin of coating open (especially in summer) and if necessary add 0.1–0.2% of OECE ***89G-03***, diluted 1:1 with water. Foul-smelling product is no longer usable and must be replaced with fresh product.

Joinery complex geometry

Sometimes the particular geometry of the door or window frame or shutter prevents the protective wood stain from flowing and even prevents the workpiece from being set at the necessary angle. That gives a very poor aesthetic result, with the appearance of patches (where the wood stain builds up) and/or streaks. Obviously, the best solution is to avoid complex geometries as far as possible for flow-coating. Such items should be treated outside the line. If that is not an option, boost protective wood stain flow by adding 4–6% of OECE ***971-22*** extra slow thinner.

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Flow-coating

OECE products can be applied using normal dipping and flow-coating systems, provided that the materials used to make the equipment are suitable for contact with water.
For low-coating, we recommend:
. the use of diaphragm pumps (see the image below), these have proved to be the most suitable for water-based products;
. stainless steel tanks (avoid those made of galvanised sheet metal or iron);
. to equip the plant with a continuous product filtration system, to separate out solid residues (e.g.: sawdust) that build up;
. plant pipes should preferably be made of plastic and have an adequate diameter.

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HIGH PRESSURE SPRAY APPLICATION SYSTEMS

Operating principles

Any pressurised fluid forced to pass through a small hole becomes very fast and it separates it into tiny droplets on impact with the air (atomisation: see photo).

The pressure needed to atomise the coating is proportional to the product viscosity and molecular cohesion. In theory, obviously having the necessary pressure available, any liquid can be atomised.

In practice, available technologies limit the range of pressure which can be used for this system to between 30 and 500 bar.

Equipment

The equipment for spray coating basically consists of a pump able to produce the necessary pressures, a feed pipe, a spray gun and a nozzle.

The spray gun must be easy to grip, light and must be able to withstand the high pressures produced (usually between 90 and 250 bar). Its job is exclusively to start and stop the supply of coating.

The nozzle, usually made of tungsten carbine, is just a calibrated hole with more or less deep milling that determines the extent of the spray fan pattern. Considering the very compact dimensions (from 17 to 38 hundredths of a millimetre), the hardness of the material and the fact that the hole defines the shape and homogeneity of distribution of particles in the jet, obviously that machining must be extremely precise.

There are also adjustable nozzles which allow variation of the flow rate and the extent of the spray fan pattern according to requirements. Improved results can be obtained using special accessories such as pre-atomisers, designed to eliminate any turbulence in the fluid and to provide an even jet and particle size. The jet is more homogeneous and allows more precise application. The pre-atomiser is also made of tungsten carbide, to guarantee a long life.

The most widespread system for pressurising a coating is the pneumatically operated one, consisting of a double-acting piston pump, operated by a pneumatic cylinder. The piston pump has the significant advantage of having a very constant pressure and allows a higher quality finish than other types of pumps.

Pump performance is defined by the compression ratio (the ratio of the motor cylinder thrust surface to the fluid pump thrust surface).

Example: applying a pressure of 3 kg/cm^2 to the motor of a pump with compression ratio 30:1, gives a pressure of 90 bar on the coating.

There is a wide range of pumps for wood coating:

- » for applying stains from 7:1 to 12:1
- » for applying coatings from 28:1 to 45:1

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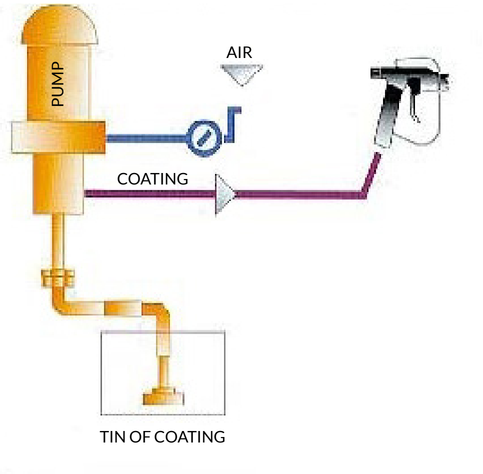
Flow rate: the volume of liquid moved by the pump with each system (upstroke and downstroke) multiplied by the number of cycles that the motor can perform in one minute. In practice, it is a good idea to use the equipment at 30-40% of its maximum capacity so as to avoid “stress” phenomena on the coatings applied.

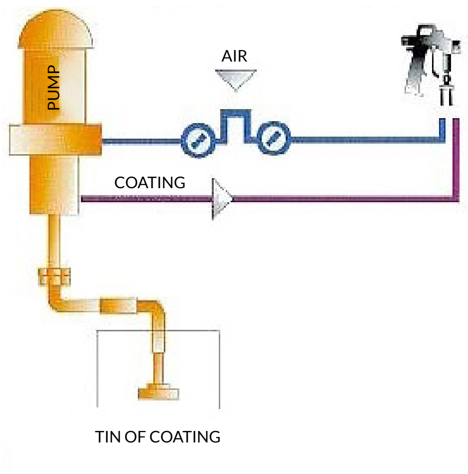
AIRLESS and AIRMIX spray guns



Spray application systems are basically split into:

- AIRLESS
spraying without air (operating diagram on the left)

- AIRMIX
air-assisted spraying; this is airless spraying with the addition of a feed pipe which carries air close to the nozzle (operating diagram on the right)



AIRMIX differs from AIRLESS as follows:
- lower pressures (between 80 and 100 bar), since air assisting the coating jet promotes product nebulisation;
- less overspray and therefore less loss of material, reducing costs;
- possibility of controlling the spray jet by adjusting the air in the spray gun;
- lower speed during application;
- less wear on the nozzles or other components thanks to the lower pressure of the material.

Users prefer the airless spray gun for high speed and high thickness application. Airmix is preferred for its uniformity and improved atomisation of the coating (e.g.: spread).

The airless spray gun (see photo) has no adjustments. To vary the quantity of coating sprayed or the extent of the spray fan pattern, the nozzle has to be changed.

There are special adjustable nozzles for sale. However, due to the lower amount of jet and atomisation, these are only recommended when frequent flow rate and jet extent adjustments are required.

The only adjustment to the system is the spraying pressure, obtained by increasing or reducing the motor air pressure supply, since the pump is essentially a pressure multiplier.

The optimum spraying pressure is the minimum necessary to obtain sufficient atomisation to apply the coating evenly.

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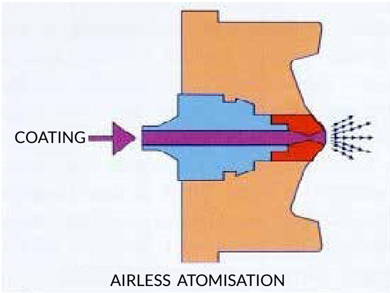
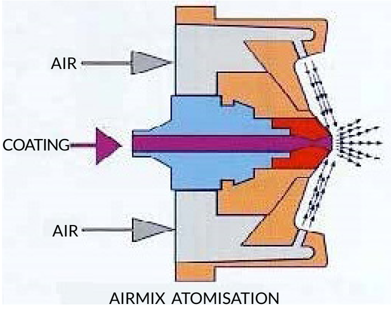
Adjustment is extremely simple, since, if the pressure is not sufficient, two lines of coating ("a moustache") appear at the sides of the spray fan pattern. Therefore, it is best to start with a low pressure and gradually increase it until the "moustache" disappears (see figure alongside).
Vice versa, further increasing the pressure results in unwanted phenomena such as overspray and considerable coating "bouncing" on the workpiece, which is why operating at pressures that are too high is not recommended. Once the optimum atomising pressure has been found, the quantity supplied may then be increased or reduced using a nozzle with a larger or smaller hole.



In airmix systems, that is to say, airless plus air, adjustment is possible on the spray gun (photo, left). It acts both on the size of the spray fan pattern and on atomisation (figure, right) opening or closing the supply of air to the nozzle.



<u>Pre-heater</u>

A hydraulic pump's ability to finely atomise a coating is also proportional to the product viscosity. Coating viscosity is usually lowered to optimum application levels by adding a suitable thinner (water in the case of OECE waterborne coatings). However, viscosity is also greatly influenced by temperature. Therefore, the use of a special pre-heater, set to an optimum temperature (normally between 30°C and 35°C), may increase the product temperature, reducing its viscosity and so allowing effective atomisation. Use of the pre-heater, especially during winter months, also greatly helps coating spread and deaeration with improved aesthetic results.

<u>Systems for water-based coatings</u>

Many spraying systems currently for sale are made of aluminium and iron. Water-based coatings corrode both aluminium and iron: these system wear quickly (especially the spray gun). It is therefore extremely important to use an airless or airmix pump whose parts in direct contact with the water-based coating are made of stainless steel. In this way, the coating will not damage the system by chemically attacking it and that will guarantee a long lifetime and easier maintenance.

<u>Electrostatic systems</u>
These systems use the forces created by applying a strong electric field to a spraying system, usually airmix (more rarely airless). The field is generated by a direct current with voltage of approximately 120,000-130,000 V and a weak current of around 2-3 mA, and is applied using a special generator directly on the spray gun.

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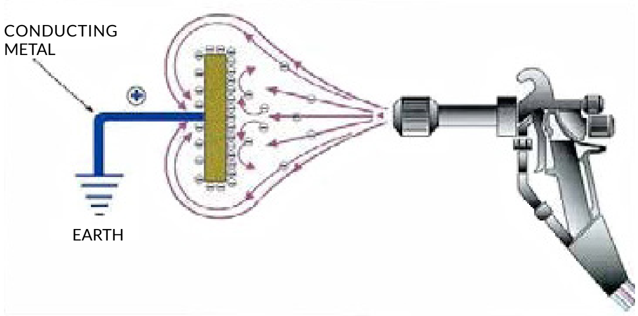
The difference in potential created between the spray gun nozzle which sprays the coating and the workpiece to be coated which is electrically earthed (that is to say, with zero potential), charges the particles of coating which, repelling each other, are further separated, promoting greater atomisation than in a traditional system.

This ensures that the coating droplets that would normally go beyond the workpiece and create overspray, are attracted by the workpiece and deposit on it, even at the back. (see photo).



Due to their high conductivity, water-based coatings can be used in these electrostatic applications, but only with special application techniques. The system, suitable for spraying water-soluble products and therefore safe for the user, complete with a spray gun (usually airmix but also airless) and generator, offers the following advantages:
- excellent all-over coverage of the workpiece;
- significant savings in terms of material and time.

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Measuring the wet thickness of a coating

One of the parameters which decisively influences the life of a coating system for exteriors is without doubt the quantity of coating applied.

Therefore, coating thickness is a very important value which must always be kept under control by the person applying it. Measuring the quantity of coating applied on the workpiece is extremely easy using a simple instrument called a thickness gauge. Normally made of non-deformable metal, the thickness gauge measures the wet thickness (wet coating just applied) of any coating. It is made up of a set of teeth (like a comb) each having a clearly defined depth (expressed in microns). The teeth are arranged in a scale which increases at regular intervals depending on the instrument calibration (the best are sensitive to intervals of between 10 and 25 microns).
Immediately after a coating has been applied, measure the quantity actually deposited on the workpiece as follows:

- carefully rest the teeth of the thickness gauge on the wet surface;
- read the wet thickness applied, which is between the last wet tooth and the next tooth. This corresponds to a value, which is marked beside it, indicating the thickness of the coating applied, expressed in microns.