Powder Coating

Technical risks and hazards associated

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General

There are several hazards and risks that can arise from the incorrect application of powder coatings. As such, it is important to read EFD information sheets (application-specific information from FreiLacke) and technical data sheets carefully and follow the instructions given. The following points are intended to explain these hazards and risks in more detail and offer helpful solutions.

Risks during transport and storage

Packaging material

Depending on the coating system, choosing the wrong packaging can lead to problems such as leaching, where water stains are caused by the diffusion of moisture into the coating film. Packaging consisting of polystyrene boards between coated components could act as a sponge and accelerate the effect of water stains. Placing coated components close together could, due to the resulting friction, lead to abrasions and scratches → place packaging material between the components. Some systems with film packaging can turn yellow as a result of exposure to UV rays → protect them from direct sunlight, e.g. put them in a box.

It is important to select packaging materials that pose no risk of damage to coatings.

Temperatures during storage and transport

Incorrect temperatures during storage and transport can have negative consequences. Detailed explanations of these consequences and possible solutions are provided in the following table.

Causes	Consequences	Recommendations
Transport to southern countries Heat above 25 °C standard temperature	Can lead to clumping	Refrigerated transport
Summer time e.g. material is stored in a lorry over the weekend	Can lead to clumping	Refrigerated storage
Packaging type too large e.g. BigBag	Can clump more quickly, glass transition temperature exceeded (Tg)	Choose a smaller packaging type, store in a cool place

Containers should not be exposed to direct sunlight.

Particularly vulnerable systems

- Wheel primers, e.g. PB7205B, PB6205B and PB6005A
- Clear coatings, e.g. PR1004B, PH1004B
- Low-temperature system
- PT910 curing polyester systems, e.g. PT1005B
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See

EFD Info 15 "Guidelines for storage and application conditions of powder coatings"
EFD Info 504 "BIG BAG handling for powder coating lines"

Points to observe when cleaning equipment/booths

- Clean using clean, oil-free and grease-free compressed air only
- Clean carefully and thoroughly
- Clean especially thoroughly when switching to a different colour
- In the case of critical products, e.g. coarse texture systems, separate hose lines should be used
- Acrylic powder and standard powder coatings should never be applied in the same room or booth
- Plastic booths should be cleaned in such a way that the booth is not damaged (e.g. scratches in which powder coatings could accumulate → contaminants)

Failure to follow these instructions may lead to surface defects and/or spot formation.

Coating care

A dry cloth (e.g. microfibre cloth) should always be used to wipe clean powder coating surfaces.

Important points to observe when cleaning surfaces:

- Do not use any abrasive polishes
- Only use pH-neutral cleaners, e.g. Pril
- Take note of cleaner mixing ratios
- Do not use any solvents when cleaning
- Regular cleaning
- Wiping powder coating surfaces hard, especially in the case of matt surfaces, can lead to a polished effect.

See EFD Info 8 "Cleaning recommendation for powder-coated surfaces"

Problems caused by the incorrect choice of pretreatment/substrate/coating

Choosing the right substrate is very important with respect to subsequent corrosion protection.
If a substrate and the accompanying pretreatment are not selected so that the coating can also meet desired requirements at a later date, this can lead to problems. It is always important to match coating systems with the appropriate pretreatment and substrate. The following examples illustrate these problems in more detail:

Cause	Consequences	Recommendations
Poor pretreatment	Delamination problems, insufficient corrosion protection	Pretreatment should take place promptly before coating, monitor bath values, always use a suitable pretreatment for the coating system
Spreading of pretreatment chemicals into other baths	Inadequate pretreatment, baths need to be set up again (reduced service life)	Rinse well, optimise suspensions (fewer dipping points)
Incorrect pretreatment e.g. in case of stainless steel	Unnecessarily high costs arise	Match the pretreatment with the appropriate substrate
Hardened oil layers	Surface defects, craters, loss of adhesion	Eliminate by means of radiation or pickling
Prolonged/incorrect storage of pretreated substrates	Missing properties, e.g. corrosion protection and adhesion	Avoid prolonged storage, maintain storage temperature, protect against moisture
No pretreatment systems, only manual cleaning	Inadequate pretreatment, delamination problems, dirt remains on the substrate	Use automated pretreatment equipment, thorough cleaning of objects to be coated, replace cleaning cloths regularly

Errors during coating application

Cause	Consequences	Recommendations
Inadequate earthing	Electrostatic discharges (non-homogeneous powder output), blemish and streak formation, craters	Earth all coating lines and objects to be coated
Layer thickness too thin/thick	Popping, blistering, inadequate mechanical and chemical resistance, inadequate substrate coverage	Check layer thickness, correct coating line parameters
Oily compressed air	Poor flow properties of the powder coating (fluidisation), bonding and clumping of the powder	Oil separator, check compressed air
Unsuitable choice of oven	Not all systems can be baked directly in a gas-fired oven; sometimes this can change colour, gloss, etc.	Check beforehand whether the selected system can be baked in the available oven
Mixed construction using materials of different thicknesses	Due to their different material thicknesses, components could be baked in the oven for too long or not long enough (see Dangers of incorrect baking)	Check beforehand whether the coating can withstand these conditions
Incompatibility with other coating systems	e.g. acrylic and standard powder coatings can result in severe surface defects	Pay close attention to technical data sheets and EFD information sheets; always use separate hose lines
Multilayer structure	The first layer must be able to withstand the baking conditions of the second layer, otherwise it may cause popping and pinholes; adhesion problems between layers may occur	Check beforehand, read TDS
Insufficient cleaning of coating line/equipment	Spreading of other powder coatings into the coating line, pinholes, craters and stippling	Always clean carefully
Conveyor speed and gun speed are not in alignment (automatic coating lines)	Streak formation, coating too thin in some places, change in appearance	Adjust parameters
Insufficient cross-linking as a result of short baking time and/or low temperature	Loss of adhesion, poor resistance, excessive gloss	Set temperature accurately, monitor time spent in oven
Thermal expansion coefficient between the substrate and coating too highly differentiated (vehicle construction → engine heat)	Crack formation, flaking	Choose a coating system that is designed to withstand these stresses

Cause	Consequences	Recommendations
Powder coating boxes not resealed	Foreign particles can contaminate the powder coating and lead to surface defects and changes in colour and gloss	Reseal after use using a reseal clip
Exposure to chemicals	Paint is attacked, softening/swelling, diffusion of chemicals to the substrate (corrosion), loss of gloss, colour changes and loss of adhesion	Check chemical resistance (determine duration, concentration and type)
Silicone, hand cream, dirty work clothing, dirt, hairspray/hair gel	Surface defects	Work in a clean environment, do not wear any jewellery containing silicone, use silicone-free seals, take note of hairspray/hair gel ingredients
Dirty substrate	Adhesion problems, craters, change in appearance (cf. Pretreatment)	Pickle thoroughly and protect against dust/dirt and moisture
Mixed construction using different materials (e.g. aluminium + steel)	Colour and gloss level do not match	Cover the substrate better using appropriate primers, choose coatings with high opacity

Dangers of incorrect baking

Overbaking (temperature too high, too long in the oven → conveyor stop)
- Yellowing (light colours are especially at risk)
- Brittle films
- Decomposition of the structure
- Gloss change
- High levels of overbaking can cause poor mechanical resistance

Underbaking (temperature too low, not long enough in the oven)
- Poor adhesion and hardness
- Reduced chemical resistance
- Incomplete cross-linking
- Excessive gloss (matting additives are not yet "active")

See

EFD Info 4	"Overcoating of powder coatings"
EFD Info 7	"Environmental information pertaining to the application of powder coatings to radiators"
EFD Info 504	"BIG BAG handling for powder coating lines"
EFD Info 508	"Baking and curing of powder coatings“

VdL guide for the planning of powder coating lines
*(www.freilacke.de/.../doc/.../**VdL**_coating%20plant_concellor_DE.pdf),*

VdL guidelines "Permitted colour tolerances for single-colour powder coatings for architectural applications"
(http://lackindustrie.vci.de/Seiten/VdL-Richtlinien.aspx)

VdL checklist for problem-free powder coating applications
(http://www.freilacke.de/fileadmin/doc/index/EFD-Infos/Pulverlacke/VdL_Check%20list_supplement_power-density-promotion_DE.pdf)

Images of coating defects

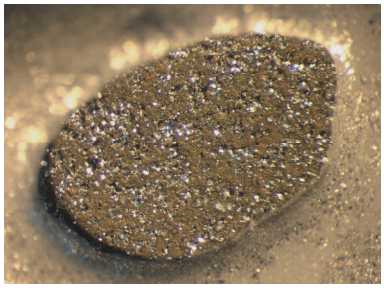

Fig. 1: Popping

Fig. 2: Popping

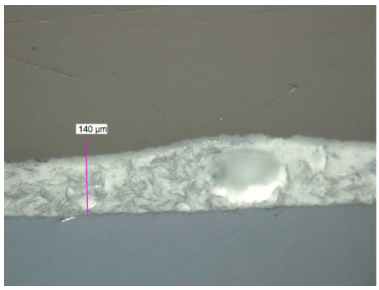

Fig. 3: Outgassing

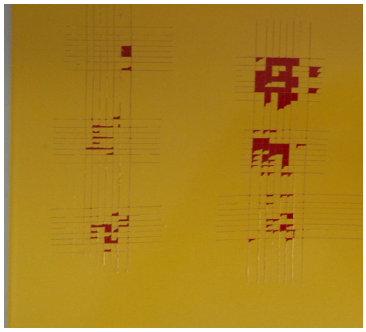

Abb. 4: Poor adhesion

Fig. 5: Blushing

Fig. 6: Colour change

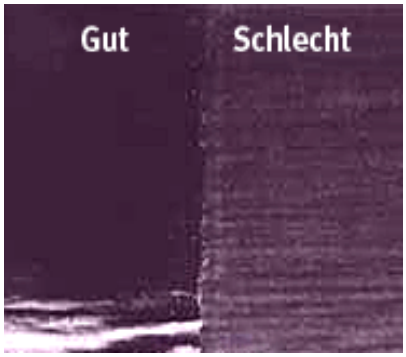

Fig. 7: Loss of gloss

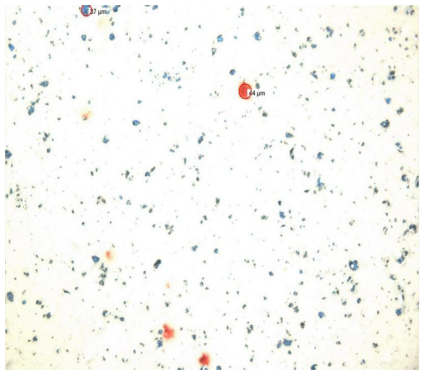

Fig. 8: Impurities 10000:1

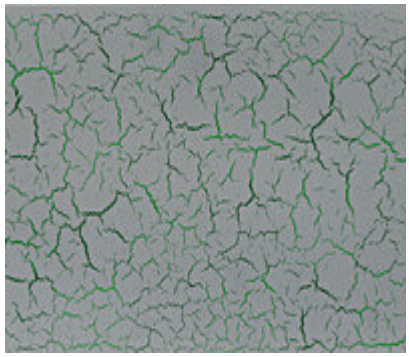

Fig. 9: Crack formation

Disposal of powder coatings

When disposing of powder coatings, it must be ensured that thermal recycling (incineration) takes place or that a company such as Nelco processes and recycles the powder coating.

Risks associated with machining processes e.g. bending, milling and drilling

Machining that takes place after coating application is known as *post-forming* and can cause several problems if an inappropriate coating system is used. In addition, the bending radius and type of post-forming tool must be taken into consideration. It is therefore extremely important to discuss this with the manufacturer in advance and match the mechanical resistance of the coating to specified requirements.

Possible consequences arising from incorrect coating selection / application:

- Scratches
- Crack formation
- Flaking
- Mouse teeth when milling
- Drilling emulsions can damage the coating and change visual properties, e.g. gloss level fluctuations, colour changes
- Blushing, e.g. from bending a black-pigmented powder coating

Overcoatings

Powder coating on liquid coating

Applying a powder coating as a top coat for a liquid coating is not recommended. This is because the baking temperature of powder coatings often exceeds the temperature stability of liquid coatings.

Applying a 1C liquid coating as an overcoating

Adhesion must always be checked beforehand. It is recommended that the surface be sanded before applying the overcoating. Please follow the relevant application instructions.

Applying a 2C liquid coating as an overcoating

2C liquid coatings can be coated over without the need for sanding. However, it is necessary to check beforehand whether there could be any adhesion problems between layers.
Certain waxes and powder coating additives can have an extremely negative effect on adhesion.
A coating structure comprising a powder coating as a primer and a 2C liquid coating as a top coat is very Resistant to chemicals and also has far better properties than a 1C liquid coating. Please always follow the relevant application instructions.
2C liquid coatings are used, among other things, as repair coatings for built-in components.

See EFD Info 4 "Overcoating of powder coatings"

Powder coating on powder coating

The compatibility of the two powder coatings must be checked. If they are not compatible, this may lead to surface defects such as craters. Adhesion between layers should also be checked beforehand. Powder coating on powder coating is suitable as a repair coating over large surfaces and is recommended wherever high corrosion protection is required.

Electrodeposition coating / water-based dip coating as primer, powder coating as top coat

These primers combined with the subsequent application of a powder coating can lead to changes in the mechanical properties of the powder coating, defective layer structure due to the insulating primer layer, reduced adhesion, e.g. following different rest times between coatings, poor adhesion between layers in cases of incompatibility, pinholes and blistering caused by cracking products. The same applies here: a preliminary check is recommended.

If the aforementioned corrective measures do not solve the problem, please contact the applications department of your powder coating manufacturer.
Additional information is available in our safety and technical data sheets.