

TI118 – Process engineering recommendation for the powder coating of sandwich panels

Preliminary information

Even with the most careful preparation, it is possible that the primer of the panels will not build up sufficient adhesion strength to the powder coating. Due to the large number of different primer coatings on the market and their chemical properties, this cannot always be avoided in individual cases.

The same applies to the connection between the metal sheet and the insulating foam. Due to the large number of insulating foams, there will always be individual cases where the metal will peel off even if the temperature is controlled very carefully. A temperature stability of the bond (metal/insulation) of at least 130°C is necessary, a stability $\geq 140^{\circ}\text{C}$ is recommended.

Aims of the pretreatment

The important objectives of preparing metal insulating foam panels include

- Building up adhesion strength for powder coating
 - Avoiding defects or dirt in and on the surface
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Pretreatment process steps

Various steps are available to achieve the best possible bond between the panel and powder coating:

Dedusting/degreasing:

For all coatings, the surface must be free of dust, oil and grease before coating. Oil-free compressed air can be used to remove dust. In addition, a clean silicone-free work glove or a leather glove can be wiped over the surface to loosen any dust that is stuck to it. Solvent-free surfactants and soaps (e.g. BONDERITE C-NE FA, Henkel / Nabu Clean soft, Nabu) are recommended for degreasing. After Cleaning, the surface must be rinsed with demineralised water to remove surfactant residues. The surface must then be dried. Avoid vigorous rubbing, as this can electrostatically charge the surface, which has a negative effect on the coating.

Solvents such as ethanol or paint thinner can attack or penetrate the primer and thus lead to severe surface defects in the subsequent coating process.

In some cases, degreasing and dust removal from the surface is sufficient to ensure sufficient adhesion strength.

Sanding:

In order to roughen the surface and thereby improve the adhesion of the powder coating, it can be sanded. However, this process should only be carried out after degreasing or on a surface free of oil and grease.

The work can be carried out both manually and mechanically. In both cases, it is important that no excessively coarse sanding material is used and that the primer is not sanded through to the metal substrate. Sanding through is to be expected quickly, especially with textured surfaces.

A fine sanding fleece or sanding sponges are recommended as sanding material. However, fine sandpaper with a grit size \geq P240 can also be used.

Electric sanding rollers or radial sanders with non-woven rolls or brushes are recommended for the series process. With these devices, a high surface performance can be achieved without sanding through the primer. With these techniques, throughfeed systems are also conceivable in special machine construction. After sanding, the surface must always be thoroughly dedusted, as described above.

Flame treatment/plasma:

As with plastic coating, the surface of sandwich panels can also be activated by flame treatment or plasma preparation. In both cases, it must be noted that a temperature is applied that can exceed the load-bearing capacity of the sandwich composite.

Plasma pre-treatment is technically very complex and cannot be carried out in in-house tests. For this reason, only flame treatment is described below.

In this process, an oxygen-saturated gas flame (deep blue flame) is passed over the surface in a uniform, not too slow movement. The flame strikes the surface over half its length. Oxygen radicals in the flame accumulate on the surface and provide a kind of bonding agent between the primer and the powder coating.

This effect only lasts for a few minutes, which is why the coating should be applied directly after the flame treatment.

Regardless of the pretreatment, the adhesion strength between the primer and the powder coating should be checked regularly using the cross-cut adhesion test in accordance with DIN EN ISO 2409. A measured value of GT0-GT1 should not be exceeded. Due to the moisture that can have an influence, a boiling test (AA341.04) followed by a new cross-cut is also recommended. Alternatively, outdoor exposure is also possible.

Mounting/positioning for the coating

The panels are usually only coated on one side, which is why a horizontal coating is recommended. This means that it is not necessary to cover the back or adjust the coater accordingly. However, it must be ensured that the metal of the sandwich composite is sufficiently earthed. This is a basic requirement in order to achieve a uniform coating result and to ensure a safe coating in accordance with ATEX Directive 2014/34/EU, EN 50177, EN 12981.

Application

In order to achieve the best possible surface, the coating quality must be as uniform as possible.

For this purpose, attention should be paid to a so-called "soft cloud". This describes the fact that the powder cloud flows evenly as it exits the spray nozzle without travelling at high speed or pulsating at too low a speed. As the parameters required for this are individual for each system and depend on various factors (hose diameter, hose length, injector type/pump, spray nozzle), no recommendations can be made here.

Please contact our technical service department, who will be happy to work with you to determine and set these parameters for your coating plants.

For the spraying distance (spray nozzle to substrate), distances between 180-250 mm are recommended, depending on the speed of the powder cloud. For powder coatings containing effect agents, it may be necessary to increase the distance up to 300mm to avoid streaks or cloud formation. If the distance is too small, this can lead to uneven layer thicknesses.

An incorrectly adjusted gun movement can also lead to streaking or uneven layer thicknesses. To calculate the correct movement, please also contact our technical service, as this must be calculated specifically for each system.

Due to the existing coating of the panels, a high voltage setting between 40-60kV should be selected. A limitation of the spray current should be in the range of approx. 5-50µA. It is important that the actual values during coating are observed, as these may differ from the preset values.

Caution!

Attention should be paid to possible overcharging, especially for products with a fine-structure surface, as this has a negative effect on the structural characteristics. Ion-leakage rings can be used to prevent the influence of electrostatics on the structural characteristics of fine-structure surfaces or the formation of orange peel on smooth powder coatings. These dissipate excess charges and thus homogenise the coating pattern. These are available as accessories from many gun manufacturers.

High coating thicknesses quickly have a negative impact on the appearance of the surface and more powder is used than necessary. Coating thicknesses >110-120µm should be avoided. Layer thicknesses between 80-100µm are recommended. At these layer thicknesses, the technical properties and surface of the coating are good and powder consumption is minimised.

If the system is equipped with a cyclone separator, the system can also be operated in reclaiming mode. In this case, the reclaimed powder should be added to the fresh powder in small quantities (automatically if possible) and processed. We recommend conveying both the fresh powder and any reclaimed powder via an ultrasonic screening system. This reduces any dirt that may be carried in and prevents coarse particles or lumps from interfering with the surface characteristics of the coating.

Curing

Due to the limited thermal conductivity of the substrate, the use of infrared ovens (electric or gas catalytic) is recommended.

The surface temperature is determined on a test panel with glued-on thermocouples (preferably thermocouple type K). A temperature-stable glass fibre tape (e.g. type 69; 3M) is recommended for attaching the thermocouples. The product-specific curing conditions can be found in the respective technical data sheet. In any case, practical tests are recommended, adapted to the respective object and the curing oven, in order to determine the optimum curing conditions.

In order to minimise the temperature input into the substrate, only the areas that have been coated should be heated. This prevents possible deformation or delamination.

As described in the section "Mounting / positioning for coating", horizontal transport is recommended for the panels. The horizontal coating allows gravity to counteract any possible deformation caused by the heat input on one side.

Particular attention should be paid to the surface temperature in the edge and rebate areas. As the material is thinner here, it tends to overheat more quickly and the associated probable negative consequences, such as swelling of the insulating foam or detachment of the sheet from the foam.

Falling below the required temperature/time combination should also be avoided, as this prevents the powder coating from curing completely. This can lead to losses, including a complete loss of adhesion strength and technical properties.

Our technical service will be happy to assist you in achieving the optimum settings for your components.

Suspension

The surface temperature should not exceed 40 °C when removing and stacking the finished coated workpieces. This prevents possible pressure marks in the powder-coated surfaces.

Test methods

The following tests can be carried out to test the quality of the coating:

Acetone test (IGP AA34144)
Cross-cut adhesion test according to DIN EN ISO 2409
Boiling test (IGP AA341.04)

Please contact us if you have any further questions.
