

Application Guide for Jotun Metallic and other Special Effect Powder Coatings

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1.0 Introduction

This document provides guidelines for the factory application of Jotun's metallic and other special effect powder coatings for both architectural application as well as general applications.

Jotun metallic and special effect powder coatings stand out with their superior optical depth, luster and unique visual appeal. From the subtle matte products stunningly bright and mirror like surfaces, Jotun's metallic and special effect products will be sure to add a touch of class to your finished object. Like all metallic and special effect powder coatings, metallic (or special) effect appearance is achieved due to absorption of light on the metallic and other special effects pigments, as well as the reflection of light as light bounces off from these metallic and other special effect pigments. Due to the 'flip-flop' (or orientation) nature of the pigments involved, they can typically seem to vary in appearance depending on the type of metallic effect (and other special effect) pigments, the quantity of these metallic effect pigments in the coating, the viewing angle and type of light etc which can add to their visual appeal.

It is important to mention that whilst special procedures and stringent quality control measures are in place to maintain a certain batch to batch consistency, due to their nature, the reproducibility during production of metallic effect powders is more demanding than that for solid colors.

Metallic and special effect powder coatings are generally produced in 2 ways. One, through a simple dry blend process and the other, through a bonding process. Whilst dry blending process involves simple adding and mixing the metallic and special effect material/s into the base powder coating. The bonding process involves a more complicated process that requires strong control. Bonding in simple terms, is the fastening of the metallic or special effect pigment onto the base powder particles using a precisely controlled temperature mixer by way of a mechanical fusion technology, to ensure the stable and uniform performance of the final bonded powder.

When it comes to application, in general, metallic and other special effect powder coatings are more sensitive to variations in application conditions than solid colored powder coatings. Dry blended powder coatings are much more so than bonded powder coatings. The line conditions, gun settings, the ratio of the reclaim to virgin, the distance from gun to substrates, maintenance of the equipment, type of equipment, etc can have far more influence when spraying metallic and special effect powder coatings and in general need more care and attention to achieve a consistent result than when spraying solid colors.

This document is intended as a guide for the applicator, to inform the user of the various parameters that can influence the outcome and aesthetic appearance of an object coated with metallic or special effect powder coatings, and to effectively manage those parameters to achieve the optimum outcome.

2.0 Scope

The Application Guide offers product details and recommended practices for the use of the product.

The data and information provided are not definite requirements. They are guidelines to assist in smooth and safe use, and optimum service of the product. Adherence to the guidelines does not relieve the applicator of responsibility for ensuring that the work meets specification requirements. Jotun's liability is in accordance with general product liability rules.

The Application Guide (AG) must be read in conjunction with the relevant specification, Technical Data Sheet (TDS) and Safety Data Sheet (SDS).

3.0 Safety Considerations

Safety is of utmost importance in any powder coating application plant. Proper maintenance of equipment and good housekeeping must always be on the top list of the daily, weekly and monthly routines of any powder coating application plant. Suitable Personal Protective Equipment (PPE) should always be worn in the powder application line. These includes the following:

- a. Cotton overall
- b. Dust mask
- c. Safety goggles
- d. Hand gloves
- e. Ear plugs or muffs
- f. Anti-static steel toe safety shoes
- g. Hard hat

Please refer to relevant and updated Jotun product SDS.

4.0 Metallic and Special Effects Colors

Metallic and other special effect powder coatings are generally tailor made, uniquely formulated, and tested against a known color standard or reference under laboratory controlled conditions.

There could be a color difference when matching metallic and special effect powder coatings when comparing to their liquid counterparts. As liquid paints use, several different and special types of raw materials (compared to powder coatings). Moreover, the

behavior of metallic pigments and other special effect pigment in liquid paints (which are less viscous) is different compared to powder coatings (higher viscous coatings).

It is important that Jotun and the end user should agree beforehand about the possible color differences. It is strongly recommended that color approvals are based on actual application production line.

5.0 Application Parameters

The final appearance of any item coated with metallic and special effect powder coatings can be affected by some or all the following parameters:

- Earthing of the line and the part to be coated
- The guns and charging equipment used (from various manufacturers)
- The hopper and level of powder in the hopper
- Cleanliness of the coating line and jigs (hangers)
- Gun settings; voltage (kV), current (μ A) and transportation air
- Type of nozzle
- Spraying distance, orientation of the item to be coated
- Line speed and spraying technique
- Usage of powder coating reclaim
- Re-coating
- Orientation of the main visible surface
- Substrate material

The guidelines within this document are to advise on how to manage these parameters best, to get an optimum and consistently good result time after time. Prior to application, the suitability of the entire coating line should be established by comparison with the reference panels that can be supplied on request. Once defined, all these parameters, should be recorded, kept stable and checked regularly to ensure a consistent result. Be aware too, that results may also differ depending on shape, size, orientation, etc. of the part to be coated.

Whilst all these parameters can be controlled to a great degree, to get the best result when you have a large project or multiple parts that must fit together after coating, it is best to ensure that you use a reference panel. If multiple batches are needed, then it is advised that parameters again be double checked on a non-significant part first to ensure consistency of appearance and finish.

6.0 Line and Equipment Consideration

- One of the most important considerations is the correct and efficient earthing of the coating line, the object to be coated, and all equipment used. The conveyor, jigs/hangers, oven, booth, guns and all ancillary equipment must be well earthed and all jigs/hanger connection points should be clean. A good metal to metal contact is vital for efficient coating and to avoid sparks on line.
- It is recommended that only corona guns be used when spraying metallic and special effect powder coatings. Whilst tribo may have some limited success, metallic and special effect powder coatings tend to coat the inside surfaces of tribo equipment causing shorting or failure to charge sufficiently. Tribo equipment is not recommended and if you should use it you should seek further advice from your Jotun representative. You will get a different end-result when using Tribo and Corona equipment, so it is imperative that you use the same type for consistency of results.
- All equipment manufacturers have guns and application equipment that is perfectly suitable for use with metallic and special effect powder coatings, however, each may give a slightly different end result due to charging mechanisms, design, current use, etc. For best results, it is advised that you do not mix guns from different suppliers on the same project. For advice on specific equipment, you should contact the equipment supplier directly.
- On some corona lines, ion collectors can be used to improve the application properties and appearance of the finished powder, however, when spraying metallic and other special effect powder coatings, it is advised that you do not use these as they modify the electrostatic corona field and this can influence and alter the appearance of the final metallic or special effect.
- Wherever possible, automatic guns and reciprocators should be used. These will give the most consistent results. If manual 'filling in' is needed, e.g. on recessed areas or hard to reach areas, this should be done first, prior to using the automatic guns. This allows the final result to look more uniform. Otherwise, this can lead to color/effect variations.
- In items that needs to be coated on both sides, it is advisable that, the main visible side should be coated last.
- Line speed, number and orientation of guns and reciprocator stroke speed should be aligned so as not to create a zig-zag (or zebra) effect on the object and to ensure a good even coverage with an even film thickness. For advice on how to adjust the oscillating speed and height, you should contact the equipment supplier directly.
- Wherever possible, it is recommended the guns be fitted with slot or flat nozzles rather than conical deflector nozzles. Metallic and effect pigments can build up on a conical deflector type nozzle and come away periodically causing spitting and uneven appearance of the final coating.

A fluidizing bed should always be used when applying metallic and special effect powder coatings. A stabilized fluid bed that contains the metallic and special effect powder

coatings, keeps the powder coatings well agitated for uniform transportation from the fluidized bed to the charging guns. It is not recommended to use powder directly from the box (as some application equipment allows), as one may not get a homogeneous result. This is due to potential separation of contents in the box during transportation and storage. This is far more important for dry blended products

7.0 Settings and Technique

- For optimum powder coating application process, it is recommended that grounding measurements are conducted on a regular basis. Resistance to ground should always be < 1.0 megaohm
- Spray gun voltage and current need to be monitored and adjusted carefully to suit the component being coated. Increasing the kV may result in a brighter metallic appearance but will also result in a faster build-up of metallic particles around the nozzle. Also, high kV will increase the risk of separation of the base powder and the effect pigment (more so in dry blended powder than in bonded powder) and thus high kV settings should be avoided. It is recommended that the voltage is set around 50 – 80 kV with an initial recommended application voltage of around 65 kV. Final application settings will depend on the initial coating results (e.g. achieved dry film thickness, acceptable visual appearance, etc). Current should be set (if possible) to around 5 - 20 μ A, in order to get optimum flow and appearance of the finished coating.
- Powder transportation air should also be controlled. If it is too high, it can also lead to potential separation of components in a dry blended powder.
- Gun to object distance is more important when spraying metallic coatings. Optimum should be to set the guns at 20 – 35 cm (7-14 inches) from the surface of the object to be sprayed. When spraying manually (if really necessary), again it is important to maintain an even gun distance from the part as you can get variations on edges, and back ionization if the gun is held too close. As previously mentioned, manual spraying should be avoided or minimized, but where necessary, it should be done before the automatic guns.
- Film thickness should be controlled and even as much as possible. Variations in thickness can lead to variations in appearance or edge effects.
- Nozzles, lines and equipment should be regularly cleaned, particularly in the event of any build-up of metallic pigment on gun tips etc. It is recommended to clean gun tips every 30-60 minutes if using dry blended powder.
- Where possible, the environment of the coating area should be controlled, particularly in terms of humidity. Applicators should be aware of the effect of high atmospheric humidity on the final finish. Best practice is to have a stable environment of 45% - 55%, as cold dry winter weather or damp rain seasons can influence the visual consistency. The coating area should be kept in as consistent condition as possible independent of seasonal variations.

- Once you have determined the optimum conditions to give the desired result, it is advisable to initially conduct a small production run with the established settings, prior to any continuous production. This will minimize the % rejection due to color variation. Once this is done, ensure that parameters are recorded and maintained to achieve consistent results.

8.0 Reclaim powder

One of the main advantages of powder coatings is that they can be reclaimed. With metallic and effect powder coatings, however, this is not always the case. Reclamation of the powder is one of the main differences between dry blended and bonded metallic coatings.

When using dry blended metallic and special effect powder coatings, it is strongly recommended that the powder is sprayed to waste, i.e. it should not be recycled. This is due, mainly, to the high risk of separation of the effect pigments and the base coat during the spraying process. Preferential charging of one component over another can lead to recycled powder changing color and composition over time and thus consistency on large projects will be an issue. Picture framing and other charging effects can also be more pronounced with dry blended powder.

Bonded metallic and effect powder coatings can be recycled and this is one of their big advantages over dry blended powder. However, there is still a need for some caution. The amount of reclaimed powder needs to be carefully monitored and ideally reclaim should be automated. It is recommended that recycled powder should be no more than 30% at all times. If the recycled powder level fluctuates too much, this could potentially lead to colour inconsistency over a large project. It is best practice to keep the hopper well charged and to maintain a 70:30 ratio of virgin powder to reclaim at all times. Reclaim can of course be less but should never be higher than 30%.

For more information or clarification, please contact your local Jotun representative who will be happy to assist. Powder school training can be provided on request.

9.0 Curing

To achieve an attractive visual surface with a minimum of orange peel for epoxy-polyester powder coatings (hybrid powders), a rapid heat-up is recommended for all metallic and special effect powder coatings, especially bright, high gloss mirror look (e.g. Jotun Ultra Shine). For best result, it is recommended to combine a convection oven with an IR booster to reach up to 80% of the curing temperature within 2 minutes. This will increase the output as well as provide more attractive and consistent end-result.

Other types of powder coatings such as polyesters may need a slower heat-up curve due to the nature of product chemistry.

The powder coating must be cured as specified by Jotun Powder Coatings. Please refer to relevant Technical Data Sheet (TDS). It is also recommended to conduct an oven test, once a week. E.g. proper adjustment/correction can be made, if required. The temperature is best obtained by measuring it at the thickest wall of the object, while the oven is fully loaded.

The air temperature in the curing zone must not deviate from the adjusted nominal temperature by more than $\pm 10^{\circ}\text{C}$.

9.1 Post Cure Handling

Coated components should be cooled to below 40°C before handling. Precaution should be taken to avoid damages on the finished coating during stacking, packaging, storing and transportation.

10.0 Gloss

Metallic and special effect powder coatings are not suitable for the gloss measurements with the glossmeter as effect pigments reflect light to a higher degree than their base. As a result, readings can be distorted and show deviation from the original gloss levels specified in the technical documents. Gloss comparison with the reference sample is recommended. Please refer to relevant Technical Data Sheets.

Note: The information in this Application Guide is given to the best of the manufacturer's knowledge, based on laboratory testing and practical experience. Jotun Powder Coatings reserves the right, without notice, to alter or change the content of this Application Guide.

Jotun Powder Coatings. May 2018

THIS APPLICATION GUIDE SUPERSEDES ALL PREVIOUSLY ISSUED VERSIONS