Blank Coating with Powder

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Blank coating is a process that prepaints metal prior to the part being formed. Once the blank is pretreated and prepainted, forming operations such as bending, roll forming, crimping, lock seaming, pressing and drawing can be performed without compromising the finish quality or surface properties. Blank coating, also known as precoating or postforming application, is drawing the attention of manufacturers who are looking at process changes to gain a cost advantage and increase the quality of finish. Precoating the blanks with powder has significant advantages over conventional powder coating or coil coating with wet paint.

POWDER PRECOATED BLANKS OVER CONVENTIONAL POWDER COATING

Material Savings. Precoating a flat panel is less complex than coating a three-dimensional formed object. The first pass transfer efficiency is much higher and a uniform coating thickness is easy to repeat. For example, in one specific lab test it was found that a manufacturer who generally applied 3-mil thick coatings to get complete coverage was able to reduce the coating thickness to 1.4 mil by changing to precoated powder blanks. Over a period of time the reduction in coating thickness represented a 60% savings in powder usage. Additionally, the higher first pass transfer efficiency reduces the amount of recycled powder, which not only reduces the material cost, but also produces less wear on the recovery and application equipment.

Labor Costs. Precoating blanks on a flat line automates the most labor intensive aspect of many powder coating lines, which is the loading and unloading of parts on an overhead conveyor. The movement of parts in a horizontal plane in precoating operations lends itself easily to automation and makes it possible to achieve line speeds over 50 fpm, while minimizing the labor requirements.

Quality of Finish. Precoating blanks as opposed to coating a formed, three-dimensional object eliminates the Faraday cage areas that are often difficult to coat. Maintaining an even deposition of powder coating is much easier when coating blanks.

Inventory Control. Precoating blanks leads to quicker response to assembly line demands and just-in-time inventory. The blanks can be precoated on demand or coated in advance and stored in a drastically reduced floor space.

Floor Space. Precoating lines are compact and typically occupy one-third the floor space of a conventional finishing plant.

Maintenance. Precoating on a horizontal conveyor eliminates the maintenance costs associated with stripping and maintaining the hanger and hooks in an overhead conveyor system.

Color Change. Finally, color changes can be made in several ways as with the conventional systems, but the compactness of the systems makes it easier and faster to change colors.

POWDER PRECOATED BLANKS OVER COIL COATING WITH WET PAINT

The economic, environmental and aesthetic advantages of powder coatings over liquid coatings are well known in the finishing industry. The benefits of powder precoated blanks versus liquid coating are much the same:

Emissions. Powder coatings are 100% solids. There are no solvents involved as with the wet paint systems. Therefore, the VOC emissions problem is eliminated and material disposal is much easier.

Surface Properties. Many suppliers who supply both liquid coil coatings and powder coatings for blanks claim that a tougher and improved color consistency is achieved in powder precoated blanks.

Edge and Corrosion Protection. The electrostatic wrap gives corrosion protection and to some extent reduces the risk of injury from sharp edges.

Single-Coat Application. Precoating blanks with powder is a single-coat application eliminating the need for primers. This reduces the operating costs.

PROCESS

The basic process of precoating blanks on a horizontal plane, commonly known as a flat line, is illustrated in Fig. 1. To start with, the coil is straightened out and cut into blanks. The metal blanks are then loaded onto the flat line by mechanical means such as suction cups for pretreatment. The blanks are routed through a multistage pretreatment system that incorporates pinch rollers or air knives to eliminate transfer of liquids from one stage to the other.

After the blanks are cleaned and dried, they enter the powder application booth. The basic components of a powder coating system are illustrated in Fig. 2. Powder is fluidized in a feed hopper when compressed air is passed through a porous membrane known as the fluidizing plate. Once the powder has been fluidized, it is supplied to the spray guns. The spray guns utilize an electrode that connects to the high voltage generator. When powder particles pass through an electrostatic field by the combination of voltage applied and the electrode geometry, the particles become charged and are attracted toward the grounded blanks moving on a conveyor belt.

The overspray is drawn into the primary cartridges located in the collector section by a centrifugal fan. The overspray powder is released from the primary cartridges by compressed air pulse and fed back into the feed hopper. The circulating air, free from powder, is then discharged through high-efficiency filter into the work area. The design provides uniform air flow, which helps achieve uniform coating, high transfer efficiency, and efficient use of floor space. The collector module is easily removed to facilitate cleaning and maintenance, and to ensure fast, easy color change.
The precoated blanks are transferred to a curing oven. The high line speeds and the two-dimensional part configuration lends itself to infrared curing ovens. Lab tests have shown that medium wave infrared and high velocity recirculating air can provide full cure in 60 seconds. The ability to achieve such fast cure times reduces the length of the oven and makes the system compact.

Finally, the precoated and cured blanks are force cooled and are ready for forming operations.

**SUBSTRATE CONSIDERATIONS**

Precoating is suitable on substrates that can withstand a high degree of formability. The coil suppliers, ASTM standards or the “T-bend Flexibility Testing” will provide insight into the surface cracking properties and the formability of the substrate.

**APPLICATIONS**

Precoating of blanks has been accepted in the appliance industry for applications such as cookers, microwaves, refrigerators and freezers. It is used in the roof and building cladding industry on products such as roof and wall panels and garage doors. Additionally, precoating is becoming popular with custom coaters supplying products to just-in-time manufacturing firms, which have to respond quickly to varying demand situations. Value-added service providers, such as steel service centers that want to differentiate their products and services, are also looking toward precoating as an alternative.

**LIMITATIONS**

As with any technology, precoating blanks has its own limitations. The full benefits of the precoating are realized only on a flat line. Therefore, painting facilities with overhead conveyors and compatible washers, coating systems and ovens have to replace their entire paint line. The capital cost of replacing the entire paint line and retooling the forming equipment to handle the precoated blanks are significant, making precoating most suitable for new installations or existing installations where management is willing to invest in long-term process changes.

Secondly, the product assembly operations such as welding will have to be abandoned in favor of operations such as gluing.

Finally, on a flat line it is difficult to coat both the front and back of the blanks. Therefore, when both sides of the part need a finish coat, the process becomes more complex and capital intensive.
SUMMARY

The precoating of blanks is a highly automated and efficient process both economically and environmentally. While the process is never going to completely replace conventional painting processes, it will certainly get a closer look from large manufacturers and custom coaters, who will be focusing on process changes to gain a competitive advantage. MF

Biography

Vishu Reddy, is the Marketing Manager of the Powder Systems Group of Nordson Corp. He has been involved with powder systems for five years and has worked on a variety of projects including process control in powder coating systems, new product development, in-mold coatings, and clean air act amendments and its implications for the finishing industry. He has a degree in mechanical engineering from Anna University and a masters in business administration from Case Western Reserve University.
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