

No Chance for Dirt Particles

Cleaning. Metallic sheen, specular coatings and shiny decorative articles make users' hearts jump for joy. However, it only takes the tiniest of dust and dirt grains to turn such products into production scrap. A cleaning method that utilizes sword brushes solves this problem and makes for particle-free surfaces.



A current application from Engel: a sword brush removed particles from both sides of a back-molded lap-top cover before the latter is placed in the mold (figures: Wandres GmbH)

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Products with high-gloss exteriors need to be kept as free as possible from foreign particles. With pre-formed articles and films decorated by means of hot-stamping, film-insert molding or back-molding, even the smallest particle of entrapped dirt will cause that part to be scrapped. For this reason, in-process cleaning of components using sword brush technology is gaining in importance. In the wet-wiping method, patented 20 years ago by Claus G. Wandres under the name “Ingromat method”, an antistatic cleaning liquid is used to wet the brush filaments prior to the cleaning process. A spray jet carries the liquid towards the tips of the filaments in a thin film (Fig. 1a). This method allows even the smallest particles to be absorbed by the bristles (Fig. 1b) and safely transported from the product surface to the suction system. The cleaning effect is based on three mechanisms:

- the mechanical action of the linear brush,

- capillary attraction between particle and filament, and
- reduction in electrostatic charging by the Ingromat liquid.

Clean and Dry Surfaces

One advantage of this method is that the surface, despite contact with the micro-damp bristles, stays dry and can be coated immediately. To ensure that the brush can keep absorbing new contaminants, it is cleaned in the turnaround area. For this,

the filaments of the brush are spread apart so that they can be more easily beaten by rotating blades and the dust particles dislodged. This mechanical cleaning is supported by compressed air, which eliminates capillary attraction between the dirt and filament. A suction system removes the dislodged particles from the production line (Fig. 1c).

This method was initially developed, deployed and optimized for sheet goods. Meanwhile, it can be used on a multitude of 3-D geometries. A number of different filament grades are available to suit all kinds of applications. The choice of bristle is determined by the hardness of the material to be cleaned. This means that even scratch-sensitive polymers are not left with micro-scratches that could otherwise affect their appearance. The size of the sword is determined by the product to be cleaned. For single- or double-sided cleaning of sheets, blanks or continuous webs, the sword brush is employed, while there are several variants possible for 3-D geometries: either the part is routed over a fixed brush or a 6-axis robot moves around the work-piece to be cleaned. The compact design of the power unit means that mounting

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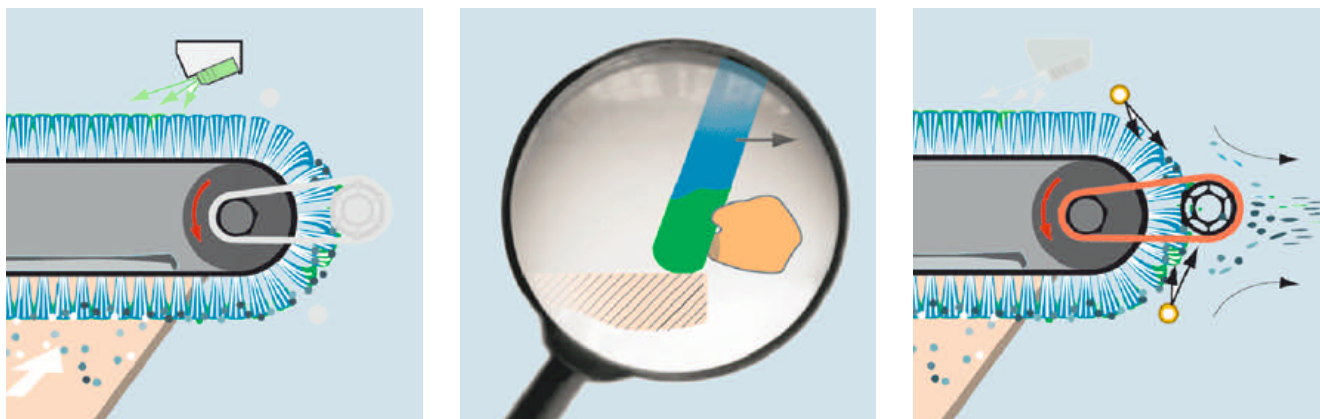


Fig. 1. The Ingromat cleaning method: the brush, moistened with antistatic liquid, removes dirt particles from the surface, transports them away and it itself is cleaned in the turnaround area

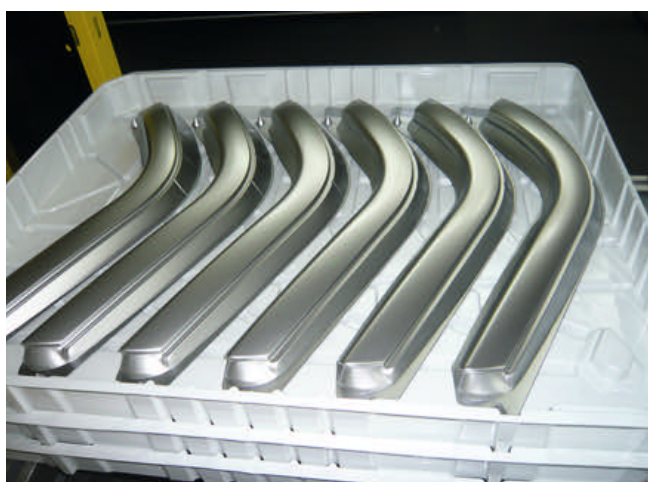


Fig. 2. Preforms, whose edges are routed across a sword brush and cleaned prior to back-molding

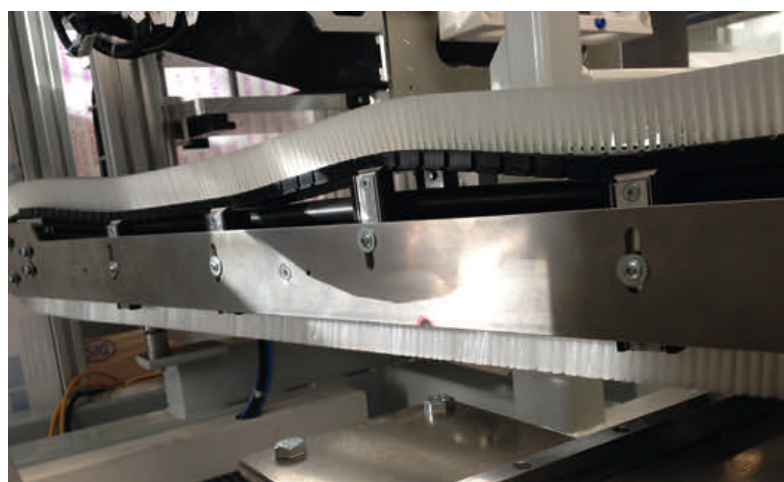


Fig. 3. A flexible buffer allows the sword brush to follow the contour of the part

the brush to a robot head is simple. In this example, a film blank pre-formed in series production is routed by a handling system over a stationary brush, before it is inserted into the mold for back-molding (Fig. 2). Once the insert has been transferred to the injection mold, the robot causes the suction cups of the handling system to be cleaned as it makes its return journey. This prevents entrainment of particles that might scratch the inserts.

The sword brush may also be pre-formed so that the parts may be cleaned in the transport line. In accordance with whether the inner or the outer surface has

to be cleaned, the belt guide is convex or concave. The small footprint means that in-line cleaning can generally be integrated into any existing line without the need for major retrofitting. This eliminates a separate working step.

Pressure Buffer for Constant Cleaning Quality

The sword brushes are fitted with pressure buffers which exert a constant wiping force at right angles to even slightly uneven surfaces. As a consequence, the filaments are in continuous contact with the surface, and cleaning quality is therefore consistent. A flexible pressure buffer compensates for large height differences, ripples etc. of +10/-20 mm relative to the surface (Fig. 3). The buffer ensures that the linear brush adjusts to convex or concave surfaces.

Sword brushes can remove the tinsel from the edges of hot-stamped parts as well as from flat surfaces. For example, particles remaining on the surface of

polycarbonate sheets after stamping, water-jet cutting or laser cutting, are removed before further processing takes place. Sword brush technology is deployed one step before that, i.e. before film decorating. Prior to entering the pressure unit or the PVD coating installation, loose particles on both sides of sheet goods are removed. This prevents them from turning up as flaws in the decorated surface.

Conclusion

The sword brush method is a highly versatile cleaning technology. Its chief purpose is to reduce the incidence of particle-induced surface blemishes, and so lower scrap rates. Production applications show that double-digit percentage improvements are achieved. ■

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