Contamination Combat

Contact cleaning methods win the battle to remove particulates from your production process, providing increased yields and reduced waste.

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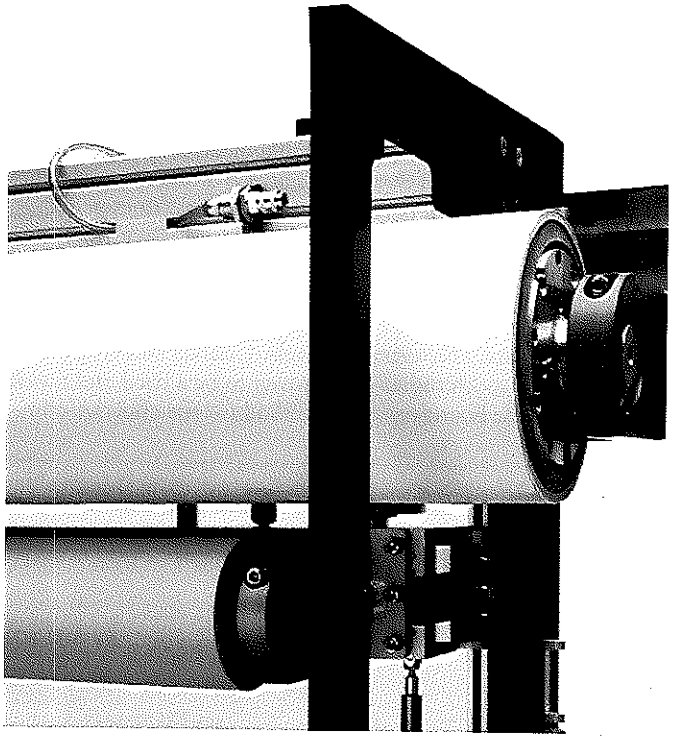
In the current economic climate, converters are under pressure to increase efficiency, cut costs, and eliminate waste. How can this be achieved without compromising quality standards? One key area that should receive close attention is how contamination and static can be removed from the production process.

Customers are demanding ever-greater standards of quality and increasingly are squeezing prices down. In this competitive environment, one of the biggest threats to quality is the presence of contamination at any stage in the production line. Previously the odd blemish may have been tolerated; now customers are demanding zero defects.

How can you control dirt and debris in the pressroom or converting department? A high-speed moving web creates static that attracts any airborne dirt or organic material onto the material being converted. The processes are a huge potential source of contamination creating slitter dust, chaff from sheeting, and loose paper fibers, additives and powders, all of which can mar the appearance of the final product. Operators also can contaminate the production environment with skin flakes (the prime source of dust), hair, and fibers from clothing and so forth.



Contact cleaners for industrial films and papers utilize tacky rolls to remove surface contamination in critical web processes. Integrating these systems with static elimination can reduce downtime and increase production yields.

As webs and sheets are fed through the printing station, particles from these sources are deposited on blankets, impression rollers, and plates, which can lead to hickeys, voids, and distorted images. Particulates can seriously impact lamination processes, and in coating, potential issues can arise such as uneven coating thickness and adhesion problems, resulting in blisters and bubbles under the surface of the finished product.

Contamination not only impacts product quality but also operational efficiency and profitability. For example, if a distorted image is traced to particles on an impression roller, the press must be stopped while the roller is removed and cleaned. This downtime can have a huge impact. A label printer operating a shift pattern, for example, could lose up to two production hours a day and create between 50–100 m of waste material.

If dust and dirt is transferred directly onto a flexo printing plate, it will cause a hickey. Moreover, if ultraviolet flexographic inks are employed, the defects become even greater as the ink is thinner and has more adhesion than other inks. Again, the impact on production can be significant, as stopping the press, cleaning the plates, and starting up again will take at least ten minutes on a four-color press and may generate 50 m of scrap.

In terms of lower yields, lost production time, and wasted materials, it's obvious the problems of contamination control and static elimination must be seriously addressed.

Contact Cleaning

So what solutions are available to tackle these problems? There are various methods employed, ranging from wiping plates with a cloth to blower, brush, and vacuum systems to remove dust and debris from the surface of the material being processed.

What Is the Bernoulli Effect?

The Bernoulli Effect, named for mathematician Daniel Bernoulli, occurs as a result of the directional movement of a flat surface (i.e., a moving web) and the friction that is created between the surface and the air. As the web accelerates, the surrounding air is drawn along.

This layer of air effectively acts as a magnet holding onto any particles. This makes it impossible to remove these particles unless the boundary layer is penetrated.

All of these methods have their pros and cons. A vacuum system must apply suction power across the whole width of the web. Should the seal between the vacuum and the surface of the web be broken, then cleaning effectiveness will be compromised. Vacuum systems can tackle moderate levels of contamination—approximately 25 microns—however, usually this is not high enough to meet today's exacting quality standards.

Brush systems have the disadvantage that the brushes potentially can damage the surface of sensitive materials such as thin films. Other methods use static elimination bars and mechanical devices to dislodge debris, which then can be vacuumed from the web.

However, the key issue is that debris sticks to the substrate like a magnet due to static and the boundary layer of air created by a fast moving web. This boundary layer, caused by the "Bernoulli effect," must be penetrated if cleaning is to be effective. Applying high-pressure air (such as in blower systems) simply disperses particles, which then land on another part of the web.

One of the most effective methods is contact cleaning. Originally developed for the microelectronics industry for cleaning PCB boards, the method has been adopted by the print, graphics, and converting industries worldwide. This method uses special elastomer "tacky" rollers to lift particulates as small as one micron in size. Although the tacky roller makes direct contact with the substrate, it does not damage or scratch the surface. However, since the rollers touch the surface, it means the boundary layer of air is penetrated, which noncontact systems cannot do. The particles trapped by the roller then are transferred onto a reverse-wound pre-sheeted roll of adhesive film. Once a sheet of film becomes saturated with contamination, it is simply removed by the operator, leaving a fresh sheet underneath.

Of course static also must be controlled, and contact cleaning systems must be used in conjunction with powerful anti-static systems so particulates are not reattracted to the web. Any good contact cleaning system should incorporate anti-static facilities to avoid this problem.

In summary, to increase yields, reduce downtime, eliminate waste, and improve efficiency, it is vital to control contamination and static levels. Contact cleaning has proven to be a tried and tested method for the effective elimination of contamination and should be part of any converter's armory in the battle for greater profits and higher quality standards. PFFC

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