

Pinholes During Production

Our printing operation is in a controlled environment, with good quality filtered air, yet we seem to suffer from pinholes caused by foreign matter. What else can we do to prevent this problem? We believe we have taken all of the precautionary measures, including the wearing of coats and hairnets.

Answer: This could be a little tricky without physically observing the operation; there are a host of potential causes for this undesirable dilemma. Putting all the cards on the table, it is generally accepted that the ideal controlled environment (cleanroom is a more common name) for screen printing will keep a temperature of $21^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$) and humidity at $55\% \text{ R/H} \pm 5\%$. More important than the numbers is the consistency between them. The greater the variation is during the shift, the greater amount of substrate movement will be experienced.

Ensure there are at least four air changes per hour — better to have six air changes per hour — at a slight over-pressure or positive pressure. The idea of over-pressure is when someone enters the room, the air from within will automatically expel, pushing dust and contaminants out with it. Otherwise, staff entering would effectively drag dirty, unfiltered air in with them each time. If access doors are swing-hinge type, make sure they open outwards and allow only authorized personnel into the area to cut down unnecessary traffic — and everybody coats-up, including the boss! (On a side note, light blue coats send out a stronger psychological message of a more “clinical” approach to a cleanroom environment than white coats.)

If it proves too difficult to separate residual heat or airflow discharging from the dryers/UV reactors into the cleanroom, at least ensure they are equipped with high-grade filters. Clean or replace the filters frequently, and periodically clean the inside of the units thoroughly with an industrial grade, heavy-duty vacuum cleaner. If your operation already enjoys a similar level of control, and you still experience problems, some additional steps can be taken for static reduction:

First, ensure that cleanroom coats worn are, in fact, static free. This may sound rather absurd, but there are many production managers going around in circles, pulling their hair out, wondering what to do, while their company-supplied protective clothing is generating the static problem!

Next, obtain expert assistance from technical consultants or specialist suppliers to see if you need on-press or dryer antistatic equipment.

Check into the feasibility of using grounded antistatic floor mats for press operators to stand on.

Remove all unnecessary paper products, such as packaging materials and corrugated boxes, from the room, because they generate a huge amount of harmful paper-dust.

Use wire storage racks instead of shelves to reduce surface areas where dust can settle.

To reduce air movement from within, remove those small fans press operators sometimes use at their workstations. (Actually, fans should not be allowed in the first place.)

Ideally, incoming room air ought to enter from high in the wall and exit from low vents. If it is entering from the ceiling (popular, but far from ideal for printing) either diffuse it or suspend a large clear orange Plexiglas-type hood over each printer and processing area affected.

Another consideration frequently overlooked or simply not recognized is high traffic movement near UV reactors. Many are designed for the barest of air movement, and air intake and exhaust ducting are not always set up correctly. The constant motion of personnel near the unit can drastically alter the air surrounding it. Such air movement can cause two problems: changes in UV curing and dust particles. Operators are especially familiar with the former when printing clear windows or textures.

Beyond ensuring that the unit airflow is running properly, you can build a small, shoulder-height separating wall of clear orange Plexiglas so people walking by will not affect the curing process.

Finally — and this step can play a major role in eliminating on-press pinholes — separately ground the print table. This is not the same as electrical grounding; you'll add a separate wire taken from a convenient spot on the print table to ground. Your equipment supplier should be able to assist in this respect.

Embracing these remedies will effectively reduce static from building up as much as possible. If left unchecked, static generated during printing attracts static dust particles, seemingly from nowhere, which creates the pinhole problem in the first place.

-- The Print Guru, Mike Young, August 2004