Substrate Shrinkage

We seem to have more than our fair share of registration problems when printing close tolerance, multicolor work on heat-sensitive materials with solvent inks. If we turn the temperature down any more it will not dry. What else can we try? *Note: Many printers are also reporting similar experiences with substrate shrinkage using UV.*

Answer: I once heard a salesman's quick respond to this very problem. He suggested the printer buy another dryer! If buying new all the time were the only viable solution, then no one would have a production problem to speak of any more. However, in a funny sort of way, there is some truth with that seemingly unprofessional response, and I will come back to it in a moment. When the size of a substrate changes, it's caused by excessive heat, whether from a jet air dryer or UV lamps. Just as certain types of materials are more prone to static than others, some materials are more heat-sensitive.

To best determine a realistic solution to the problem, one first needs to understand the distinction between the processing procedures of a heated jet air dryer (regardless of energy source) and a UV reactor.

In principle, a jet air dryer dries by removing solvents from the ink layer. To do this, it blows a controlled amount of air across the conveyor, creating a scrubbing-like action, and expels the spent air from the dryer chamber. Solvents are heavier than air and ink, so heat will bring them up to the printed surface for more effective removal. Modern solvent-evaporating inks are, in the main, "time related" rather than "heat related," so set the air dryer to run at the slowest possible conveyor speed according to production output. Once "resident" time has been established, you can then set the lowest temperature setting. A good, efficient dryer should permit printed sheets to almost touch one another as they go down the conveyor to maximize residence time. Check with your dryer supplier if there are any problems in setting up this type of protocol for production requirements.

Conversely, UV ink cures instantly through a photochemical reaction to ultraviolet light. Because of that instantaneous change from liquid to solid, you'll set the conveyor at the fastest possible speed that provides proper cure and adhesion. The problem in the field is that, for a host of reasons, some reactors cure faster than others, some cooler, some hotter — so there is no "set" answer. If the heat is too much for the substrate/ink combination, there is nothing wrong with reducing the lamps' output. In fact, there is something to be said for "controlled undercure" if carried out with full knowledge of potential pitfalls. Such will improve intercoat adhesion and may prevent damage to earlier colors printed from overcuring. Most ink suppliers will gladly setup a custom protocol in this respect. For peak performance in keeping the unit as cool as possible, ensure the lamps and reflectors are routinely cleaned according to the maintenance manual.

Providing the dryer or reactor is running properly, the only option left to improve operating condition and ensure efficient cooling is to check whether the exhaust is being restricted. Make sure nothing blocks air intake or exhaust, and that all air valves/baffle plates are fully open for unrestricted airflow. Everything can be readjusted to maximize performance later. If, at 1 meter (3 feet) away from the dryer, the heating chambers' exhaust ducts are "hot" at low temperature settings, call maintenance or your equipment supplier. Similarly, if ambient cooling chamber exhaust ducts are too warm, the dryer is telling you there is something wrong. In regards to ductwork overheating, by the way, it is possible for electricians or contractors to tinker around and inadvertently rewire fan motors out of phase, thereby causing them to run backwards!

Once you have confirmed that there is good airflow and cooling, a simple check can be made to see if the dryer is creating its own air turbulence. With heat turned off or dialed to zero, open a full page of a large newspaper and place it on the conveyor belt at normal operating speed and air damper settings. As it goes through the dryer, observe the paper to see if it lifts and flatters badly. If this happens, it shows where pockets of air may be recycling within the chamber, creating a solvent-saturated, vortex-like action that inhibits drying. All that can be done is to work with the air intake and exhaust dampers to reach a balance to eliminate the effect.

Other than buying add-on units, the above are good guidelines to keep dryers in good operational condition in an attempt to meet greater drying demands. Coming back to what that salesman said earlier, unfortunately, I have to concur that many companies simply do not have the right dryer/reactor for their specific operation. While a number were understandably brought prior to facing the challenges of today's production, some were clearly chosen solely on the basis of price, consciously under spec or without required performance knowledge — all of which will come back to bite the owners in the rear!

-- The Print Guru, Mike Young, August 2004