



# Optimizing Print Drying in Minilabs

Minilab operations can improve print stacking and packaging performance by optimizing the temperature of their dryers. Many minilab operators overdry prints without realizing it. This results in excessive print curl, and uses more electricity than is necessary for satisfactory results. This publication describes the causes of print curl and explains how to minimize curl in minilab operations.

## TYPES OF CURL

<p><b>Core-Set Curl</b></p>	<p>This type of curl occurs naturally as a result of the paper being wound on a paper roll core. The closer the paper is to the core, the more pronounced the curl becomes. Core-set curl is also more pronounced (and resistant to change) the longer the paper is stored on the core. Adverse storage conditions, such as high temperature, can accelerate the process.</p> <p>Because Kodak papers for minilabs are wound on the core emulsion side out, core-set curl is curl away from the emulsion (<i>negative curl</i>).</p>
<p><b>Humidity Curl</b></p>	<p>Conventional photographic papers on a flexible support (usually made from paper pulp and resins) are subject to humidity curl. Humidity curl results from the imaging emulsion absorbing moisture from or losing moisture to its environment.</p> <p>Photographic papers are designed to be flat in an environment of approximately 50 percent relative humidity (RH). When the environment is drier, the emulsion loses moisture, causing the paper to curl towards the emulsion (<i>positive curl</i>). When the environment is more humid, the emulsion gains moisture, allowing the paper to curl away from the emulsion (<i>negative curl</i>).</p>

## VARIATIONS IN AMBIENT HUMIDITY

Most geographical locations experience variations in ambient humidity on a daily or seasonal basis. The ambient humidity has a direct impact on the efficiency of the paper dryers in photofinishing operations. The more moisture in the air, the more drying energy is required to dry the paper.

Air-conditioning equipment can help moderate swings in ambient humidity. Besides cooling the air, conventional air conditioners remove moisture from the air in the form of condensate. Air conditioners can reduce the amount of energy needed to dry photographic paper by increasing the capacity of the dryer's air supply to take on moisture.

Adding moisture to the air during dry periods can improve comfort and reduce problems such as static electricity. Either stand-alone humidifiers or humidifiers added to central air conditioning can accomplish this.

Photofinishing equipment located in retail stores may experience relatively large swings in ambient humidity, particularly in areas that have significant swings in seasonal humidity. For example, many locations in the northern U.S. experience dry winters. Customers seldom complain about dry conditions in retail stores, so stores have little motivation to install humidifiers. However, this can lead to excessive positive paper curl during the dry months.

## OPTIMIZING DRYER TEMPERATURE FOR CURL CONTROL

Processor dryers are designed to remove moisture from photographic paper so that prints are dry to the touch, do not stick together, and are easily stacked and packaged.

### Controlling Positive Curl

If prints are overdried, they show excessive positive curl (toward the emulsion) and may not stack properly. They will be difficult to insert into wallets, and will be less pleasing to customers. Reducing the set point for the dryer temperature can help minimize these problems.

First reduce the dryer set point by 5°C. Then run production and inspect the prints for dryness and curl as they stack in the print hopper. If the prints feel hot to the touch and are curled toward the emulsion, reduce the dryer temperature again. Continue this process until the prints feel cooler and have less curl.

**Note:** If the ambient humidity is below the lower limit specified by the minilab manufacturer (usually 30 percent RH), you may not be able to lower the dryer set point enough to compensate for the dry conditions. Also, some dryers cannot be set below a certain temperature, for example, 50°C. In either case, you should increase the ambient humidity to meet the manufacturer's recommendations for operation.

### Controlling Negative Curl

Excessive negative curl (away from the emulsion) usually becomes evident only when the paper is near the end of the roll—core-set curl. You cannot correct core-set curl that occurred nearest the paper core, i.e., approximately the last 20 metres (66 feet), by adjusting the dryer temperature. When the paper has been processed, cut, and packaged, the effect of core-set curl will diminish as prints acclimate to the environment.

Paper rolls that have been stored for a long time (several months or more) or stored at high temperatures may yield prints with more negative curl than normal throughout the roll. You may be able to reduce curl somewhat by increasing the dryer temperature set point for that particular paper. Increase the dryer temperature in 5°C increments while monitoring the stacking performance in the hopper. Remember to change the dryer temperature back to the normal settings after the paper is gone.

## MONITORING DRYING CONDITIONS

Minilabs usually allow setting the dryer temperature for a particular paper as identified by the paper channel or magazine identification. It is a good idea to optimize the dryer temperature for each paper type and print size. Larger prints or heavier paper will generally require a higher dryer temperature.

Keeping a log of the dryer settings used, recording date, paper type, paper size, and ambient humidity, will help you respond effectively to swings in humidity levels.

We do not recommend “chasing” humidity levels by adjusting dryer temperatures on a daily basis. Monitor the humidity, and when necessary, adjust it for seasonal or abnormal levels for several days. Then check your print output for excessive curl and adjust the humidity as needed.

To check the humidity of the air supplied to the dryer, use an accurate humidity-measuring instrument. These devices are available from HVAC dealers or electronics shops.

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EASTMAN KODAK COMPANY • ROCHESTER, NY 14650

