

Web Heatset Blister



Sappi Printer Technical Service

877 SappiHelp (727 7443)

Problem

The undesirable surface defect appearing on both sides of the printed web are small to tea-bag sized bubble-like formations primarily in image areas of dark or heavy back-to-back ink coverage.

Description

This condition, known as blistering, is specific to web heatset printing on coated paper. Although there may be some correlation, paper delamination or fiber rupture in the units may appear as blister after the dryer and sometimes misinterpreted as a blister problem. Making this distinction early on in the discovery process is critical as delamination will demand a different approach to trouble-shooting as compared to blister.

Web dryers are designed to flash-off excess moisture and ink solvent at high box temperatures in the 350–375 ° F. (177–191° C.) range. Before the web dryer can adequately flash-off ink solvents, it must first evaporate excess moisture from the web in the form of ink water pick-up and absorbed plate moisture from the fountain solution. If moisture and ink solvents are fully evaporated as the web exits the dryer, the printed ink film then enters the chill rolls in the proper semi-fluid state. The chill rolls, pre-set to internally flow chilled water in the temp range of 55° F. (13° C.), harden and set the ink by solidifying the non-volatile resins which bind the ink pigments.

Depending upon press speed, dryer length, dryer temp pre-sets, ink coverage, and the darkness of the ink film, actual web temps typically reach 250–275° F. (121–135° C.). Since the boiling point of water is 212° F. (100° C.) at sea level, moisture on and within the web quickly vaporizes as the web passes through the dryer. If the combined moisture content and water pick-up within the paper is excessive and internally trapped due to heavy, surface-sealing, back-to-back ink coverage, the paper coating will bubble-up in a blister effect as the vapors seek to escape the sealed surface.

Similar to delamination, blister is most prevalent in heavyweight coated papers. Although web papers are manufactured to lower moisture content, heavy text or cover weight papers still contain more moisture per square inch as compared to lightweight papers. Therefore, heavyweights must have more surface porosity to allow for higher volume moisture escape.

The primary properties of coated paper that contribute to blistering are; moisture content, internal fiber bond (ZDT), and density, which is the measure of the paper's porosity and ability to pass moisture. Different paper grades have varying demands and tolerances for heat. For instance, a high-holdout gloss coated surface may demand more heat to adequately flash-off high moisture pick-up and surface solvents, whereas, a more absorbent paper of the same basis weight and finish may not need as much heat. Typically, heavy basis weight, tighter-surfaced, gloss coated papers are most susceptible to blister when sealed back-to-back with heavy ink coverage.

Web Heatset Blister (continued)



Sappi Printer Technical Service

877 SappiHelp (727 7443)

Causes

- Problem may actually be partial delamination of coating to basesheet or internal fiber rupture transpiring in the printing units.
- If the problem only occurs immediately after the roll splice, the outer roll wraps may have picked up moisture through exposure to high ambient relative humidity.
- Excessively high dryer temps, sometimes over-compensating for short dryer length.
- Slow press speed resulting in prolonged dryer dwell time in combination with high dryer temps.
- High paper moisture content and/or water pick-up through the press.
- The first zone of the multi-zone dryer may be too hot. (Most multi-zone dryers are preset to run hotter in the first zone.)
- Heavy back-to-back ink/varnish densities are adversely sealing the web surface.
- Low pigment inks are demanding heavier than normal ink films.
- Dark colored ink film is absorbing and retaining too much heat.
- Ink solvent content is too high.
- Surface porosity of paper is too low.

Options and Solutions

- Determine if problem is blister or delamination.
 - Delamination usually appears on just one side of the web, whereas, blisters are usually apparent on both sides of the web.
 - E-stop press and examine the web lead out of the last printing unit for delamination before the dryer.
 - If significantly lower dryer temps do not improve the condition, the problem is most likely delamination (See Sappi tech tip on Delamination and Considerations for Printing Web Cover).
- For blister problems at the roll-splice, be sure to slab-off at least five outer winds of paper when staging the roll on the splicer. Web paper is manufactured to lower moisture content to preclude blistering, but the outer wraps may have adversely picked up moisture either before wrapping or after unwrapping.
- Try flipping the web top-to-bottom by turning the rolls in the roll-stand.

Web Heatset Blister (continued)



Sappi Printer Technical Service

877 SappiHelp (727 7443)

- Reduce dryer temps overall or increase press speed to decrease web dwell time in the dryer. Lower dryer temps may demand a slower press speed or vice-versa. Whenever reducing dryer temps, always check subsequent prints and press loads for high residual ink solvent which may cause ink set-off, ink marking, chill-roll solvent streaking, or chill-roll ink pick.
- Avoid excessive water pick-up by minimizing water to the plate and avoid running the web through open, “wet” units. Water-based overcoats that are applied down the ink train are not recommended for heatset web.
- Test ink for excessively high water pick-up; consult with ink supplier.
- If possible on multi-zone dryers, equalize dryer box temps between zones one and two by equally decreasing zone one while increasing zone two. The dryer temp preset should be tracking actual web temp.
- Drop varnish and compare performance. If blister is eliminated, try a 50–60% screened varnish to help open the surface. Stochastic screening will avoid the possibility of moiré or visible screen pattern.
- Consult with ink supplier to explore options to increase ink pigment strength and reduce ink film thickness.
- Consult with ink supplier to explore low-solvent, low-flash ink options to allow for reduced dryer temps.
- Try under-color removal in mass-tone image areas to reduce maximum ink densities.
- Try a roll from a different position across the parent reel or from a different production run of the same paper.
- Compare performance to a competitive grade of paper with same basis weight and finish.