

Troubleshooting Paper Machine Problems Through Thermal Imaging

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ABSTRACT

The Paper Industry has numerous processes that can provide a thermal imprint. The papermaking process is based on water removal through drainage, mechanical pressing and, the application of heat. We will review four case studies to represent only a few of the opportunities to troubleshoot the process.

- Coater mark
- High pressure shower nozzles
- Cross machine profile problem
- Steam coil systems

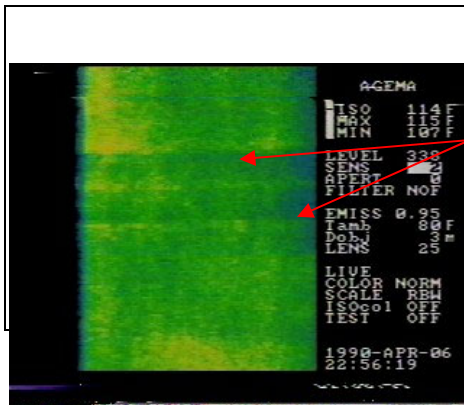
1. THE PAPER MACHINE

The paper machine is a complex system with both the addition of water and removal of water through numerous concurrent processes including chemical, mechanical, heat and mass transfer components for the paper plus steam or water cleaning systems for the textile products used in papermaking. This combination of processes makes it extremely difficult to troubleshoot at times. We are going to take a look at problems on a paper machine that can cost thousands to millions of dollars annually in off-quality production and customer dis-satisfaction. The Thermographer has to know each process of the paper machine that can add or remove heat and change the thermal image. A lot of valuable time can be wasted trying to correct a misdiagnosed problem.

My suggestion would be to send an individual familiar with the paper machine operation to an ITC course for certification, or send a person familiar with Thermography to a papermaking course sponsored by TAPPI. Another suggestion for analysis and presentation of the images is to purchase the ThermaCAM Reporter software. These actions will more than pay for themselves in a year's time.

2. THERMAL IMAGE CASE HISTORIES

1. Troubleshooting coater marks [which became visible in a customers' printing operation]



A mill was getting complaints from a printing customer where a wet mark on the paper was causing problems in processing some of the paper. The source of the problem [see Image # 1] was identified using an IR camera in the coater drying section. The thermal image shows a mark caused by the seam of a dryer fabric. The mark is between the two red arrows across the image from left to right. Since there are more than one dryer fabric in the coater drying section, the exact length of the contributing dryer fabric was then calculated using a stopwatch and knowing the actual coater speed. The calculated fabric length came to 136.6'. Each of the dryer fabrics was then measured using a measuring wheel. The closest fabric length match was the 2nd bottom dryer fabric at 136.9'. When this fabric was replaced with a pin seam the problem disappeared.

2. Troubleshooting high pressure shower nozzle problems

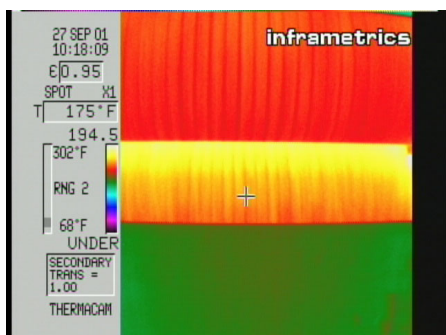


Image #2

Press section fabrics use high-pressure showers to keep them clean. Sometimes the shower flow-pattern is transferred to the paper web as illustrated in Image # 2. This condition can cause problems in the dryer section, such as rusting of return rolls which in turn leads to premature wear of the dryer fabric. In this analysis, the shower nozzles turned out to be worn and were putting more water into the press fabric than could be taken out, thus transferring wet streaks to the paper.

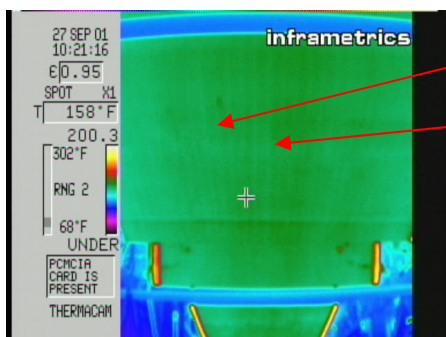


Image #3

Image # 3 shows the shower pattern from the Press section fabric transfer by the paper to the second bottom dryer section fabric, which is downstream in the paper manufacturing process. The two red arrows point out some of the shower patterns. Paper containing moisture streaks can adversely influence quality and performance of the paper in a subsequent converting and printing processes.

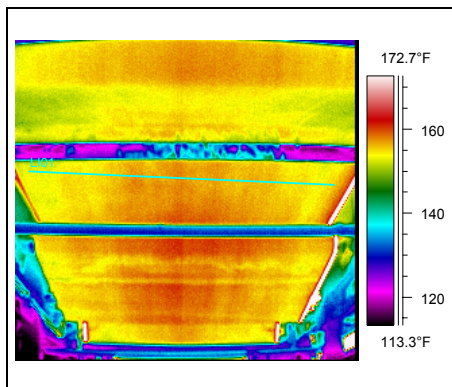


Image #4

After replacing the high-pressure shower nozzles, the shower nozzle pattern can no longer be seen [see Image # 4] in the dryer fabric.

3. Troubleshooting CD profile issues

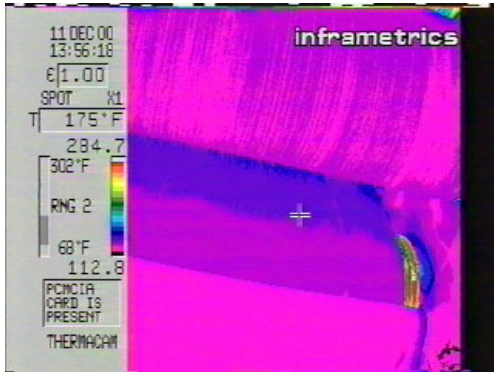


Image #5

The next two images show a Unirun dryer section fabric with before and after shots from the basement looking up to the first dryer section. Image # 5 shows a good Cross Machine Direction (CMD) profile.

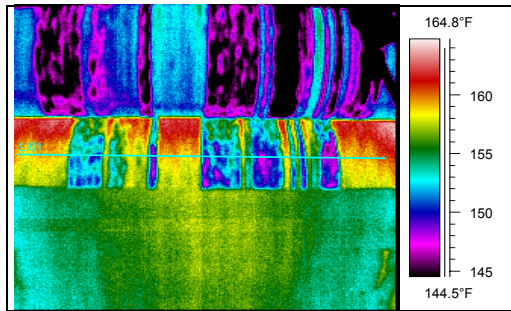


Image #6

Image # 6 of the same position shows a very poor CMD profile. In this case, a profiling steam box was used earlier in the process and this had to be eliminated as a wet streak contributor. A steambox can show a very erratic temperature profile. This image was taken with the steambox off to minimize the known variables that may contribute. The problem was then identified to originate at the continuous dryer-cleaning shower.

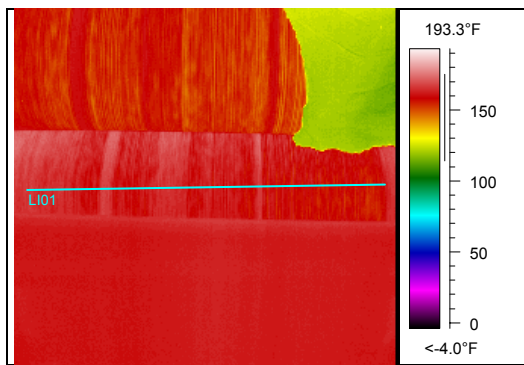


Image #7

After some maintenance on the cleaning shower pump the CMD profile shows much improvement.

4. Troubleshooting steam coils on pocket ventilation systems

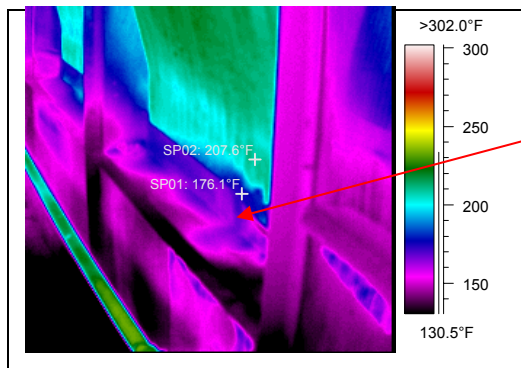


Image #8

Paper machine surveys are a routine part of our service to customers. These are intended to document good performance and to investigate known problems. Using the IR camera, we are able to “see” things, which are not visible to the eye. In Image # 8, we noticed several steam leaks on steam coils for the dryer section pocket ventilation system. Through our pre-survey meeting with this customer, we had learned that the paper machine was experiencing several unexplained paper breaks per month. The steam coils that were leaking were turned off. The remaining coils in each air supply bank provided enough warm air until the leaks could be repaired. The breaks per day were reduced and the mill gained about \$200,000 in increased production.

3. SUMMARY

The paper machine is a complex system with many individual processes, all of which need to function well to produce quality paper. Some problems on the paper machine are very easy to analyze and solve. Some problems can take several months to track down the root cause. The infrared camera is a great tool to isolate the area of the problem by providing thermal images of heat differential not visible to the eye. This can save a lot of valuable time and money in maintenance costs, improved quality and customer satisfaction. We value our Infrared Cameras. Our customers value our diagnostic capability of troubleshooting paper machine problems through thermal imaging and presenting them in a clear report format.