



WORKSHOP

24 October 2024

Implementing Energy Efficiency and Decarbonising Practices in Corrugated Manufacturing

Sheraton hotel Brussels airport



After this presentation you will be able to reduce dryer energy consumption!

Reducing dryer energy consumption

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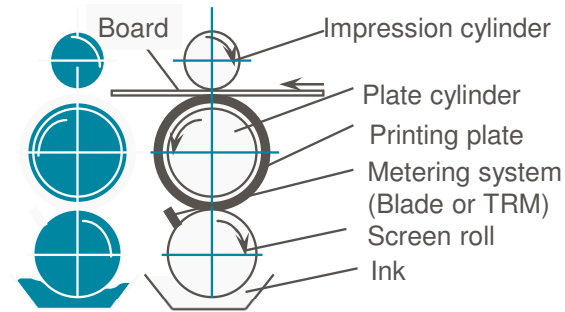
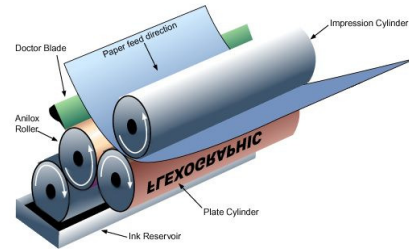
Content

- Introduction
- How is ink drying?
- Why do we need a dryer?
- How to adjust the dryer?
- Q&A

**Electric energy consumption avg.
corrugator plant: ≈ 500 k€
6 colour printer with dryer: $\approx 80-100$ k€**

**There are machines in the market with an
installed drying power of 0.6 MW!**

Introduction: What is Printing?



Printing is:

Getting the right amount
of the right ink
in the right place
on the right paper
against the right costs

The presentation is about potential energy saving by implementing a (automatic) dryer board temperature control system.



The Problem

- Operators do not have the controls to set the right dryer power level for the job. The dryer power is depending on:
 - The amount of ink transferred
 - The ink (ink water content)
 - The substrate
 - The machine speed
 - Environmental temperature

The result:

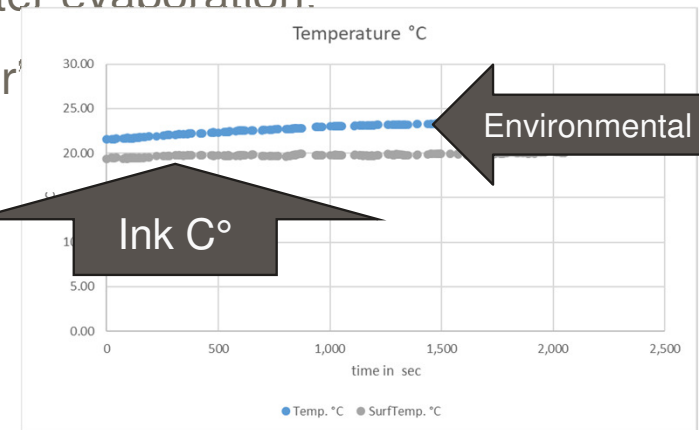
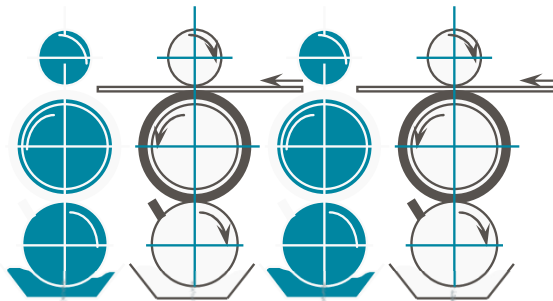
**Operator uses the dryer at 100% power
as the main thought is...**

More is better!

Why do we use dryers?

- Ink is applied on the substrate in the print nip.
- In water-based ink the amine pushes the water out from the ink when applied as a thin film.
- The water evaporating from the board surface uses “energy” from the substrate!
- The board temperature drops in every print nip due to the water evaporation.
- The by the board lost energy needs to be replaced by a “dryer”

Did you know that in most cases during production the temperature of the ink in the bucket is lower than the environmental temperature?
This is due to the evaporation of water and amine on the screen roll surface.



Board Temp



Relation Board moisture ink moisture

- From tests we learned that:
 - The moisture content in the board represents a water film of $\approx 30\mu\text{m}$.
 - The ink film printed represent a water film from ≈ 1.3 to $\approx 1.5 \mu\text{m}$.

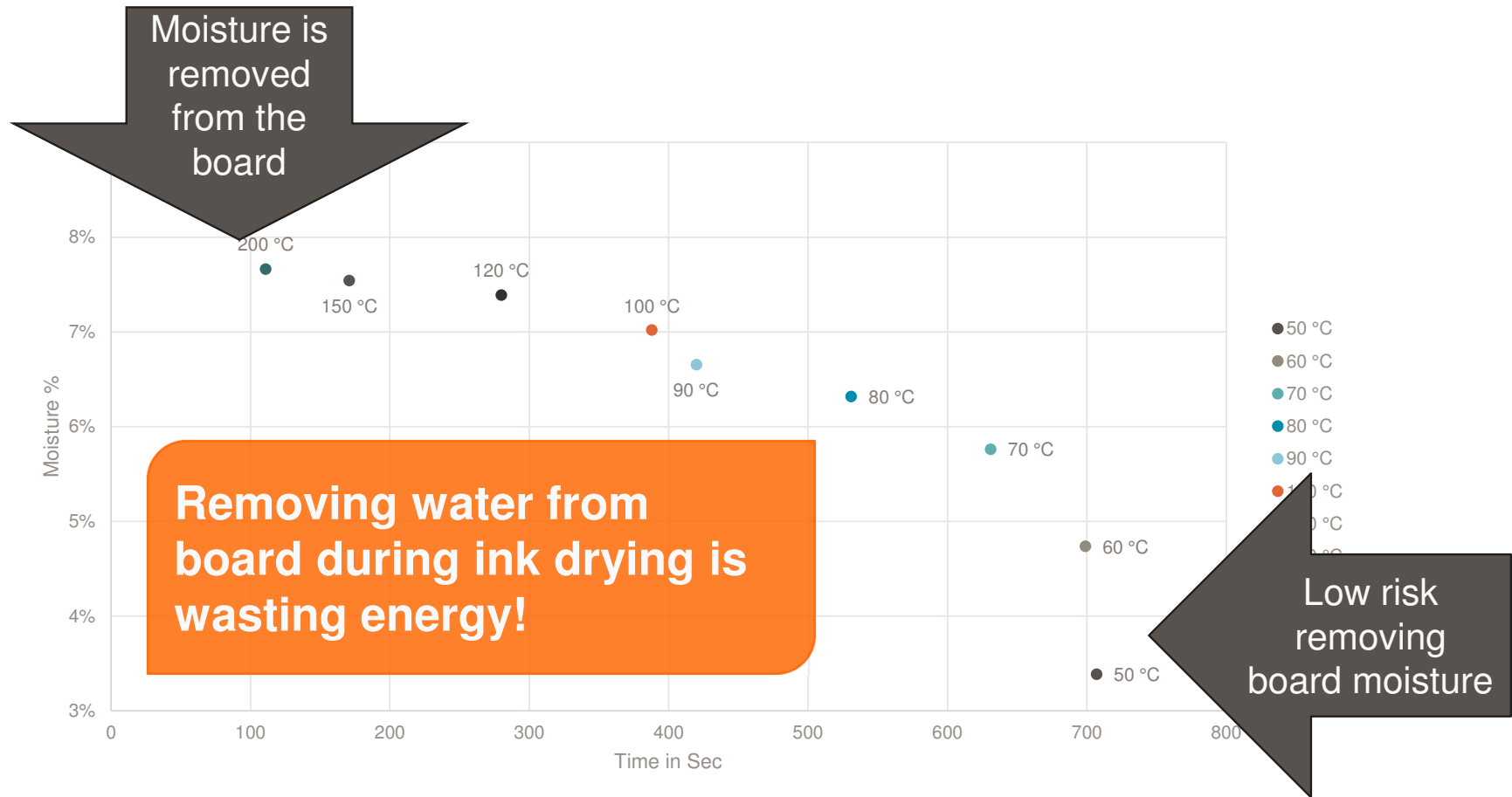
A ratio of 1 to 20!
What moisture are the dryers removing when at 100%: from the Board or the Ink?

Simulation of the dryer impact on the board

- Board samples of same size and weight are dried in moisture analyser
- Drying temperatures used: 50°C, 60°C, 70°C, 80°C, 90°C, 100°C, 120°C, 150°C and 200°C
- Measured is:
 - Moisture content at used drying temperature
 - Time used for the moisture analyzing test



Board dryness test, result



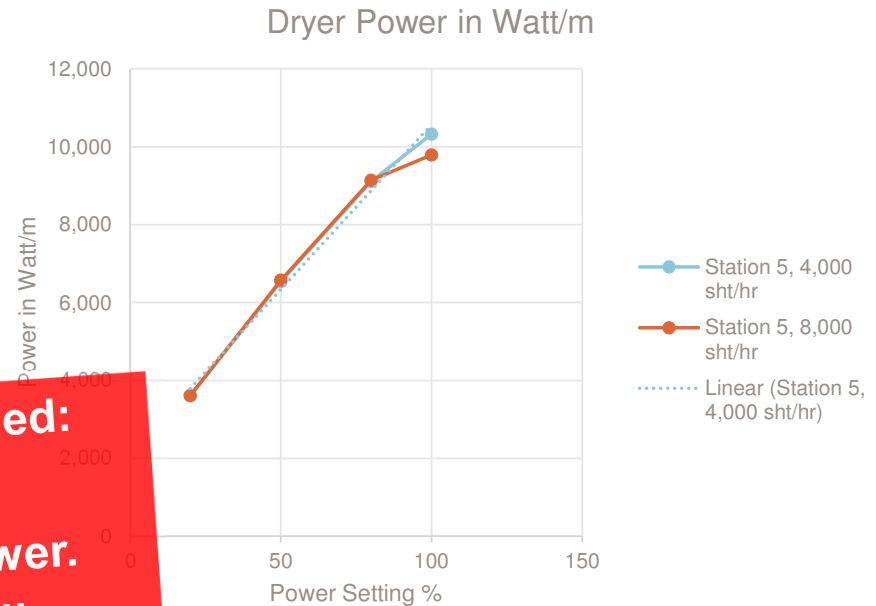
How to adjust the dryer to maintain a constant board temperature?



How is the dryer responding on the control panel setting?

- Power consumption is calculated from the 3 individual phases measured values for:
 - Voltage
 - Current

Dryer power to be controlled:
0% is 0 Watt
100% is Maximum Power.
Linear response preferred!



Measuring of board temperature

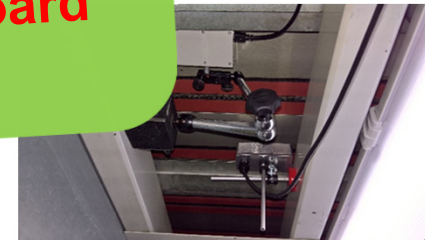
- Thermopile Detectors
- Non-contact temperature sensors examples:
 - Fluke sensor
- Example of measuring board temperature inside a machine.



The target board temperature: 35°C →
adjust the dryer power accordingly!
**Use a handheld temperature gauge or ask
your dryer supplier to implement a board
temperature control system!**

Station
S

eder and station 1,
sheet edge detection
before dryer



How does Automatic Dryer Control (ADC) work?

- The sensor positioned after the IR dryer detects the board temperature.
- The dryer control unit increases or decreases the IR dryer power supply depending on the actual board temperature in function of the target board temperature.

ADC Benefits:

- Higher print level due to no ink smearing
- Lower risk for board warp due to overheating the board
- Lower fire risk as board will never reach critical temperature
- Less setup waste linked to setting board temperature
- Lower investment as final (high power) dryer is not needed
- Lower energy consumption → lower CO₂ footprint

Dryer performance test

- Dryer performance tests were conducted to measure how much energy is needed to maintain board temperature
- Dryer energy consumption of a machine not using a board temperature control system was available including the production data

Result:

General estimated dryer energy saving by implementing board temperature control:

30-60%

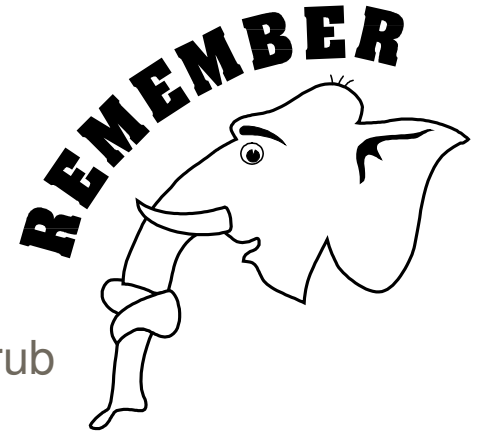
(25,000 euro/year energy cost reduction for the reference machine)



Important

"Don't increase drying power to solve ink rub problems."

- Use a good standard water-based ink (no fillers)
- Use the right screen roll in line with substrate
- The pigment extender ration should be high enough to allow a good ink rub resistance
- Press return black contains "everything" that is reducing ink rub resistance and stays always too long on the machine. → Don't use it if rub resistance is key
- Minimize die cut pressure by using a micro grind system on your anvil!



It is all about making a good product with low energy cost or bad product with high energy cost!!!



Thank you