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VARIABLE HEATING EXTRACTION TO SPEED UP WARM UP TIME AND OPTIMIZE HEATER POWER CONSUMPTION

HP INC

Variable Heating Extraction to speed up warm up time and optimize heater power consumption

Abstract

The following document describes a novel invention to optimize the warm -up time and optimizing the heating power consumption by adjusting the extraction of the heating system and controlling its flows direction.

Problem Solved

In latex ink printers, heating sources are needed to dry and fix the ink onto the media. They usually consist of a heating element that needs to be warmed up before each job and cooled down after the printing process, leading to higher preparation time over its main competitors (Solvent and UV printers). Consequently, latex technology is usually perceived as non-productive technology for short runs.

Contrary to solve this issue, as the portfolio evolves, there has been a focus in improving the print velocity (throughput) instead of the end-to-end productivity. This increase in throughput has led to bigger heating elements needing longer warm up and cooldown times.

The present invention proposes a heating module designed in such a way that by reducing the amount of air we extract from the system we can invert the fluxes, so the print zone and the curing module are optimally heated up. This flow inversion can reduce by about 50 % the warm-up time, and the curing power consumption can be reduced in low ink jobs.

Prior Solutions

We have identified 3 types of prior solutions:

- Heating elements with no active air extraction systems where the flows of the system are defined by its fixed geometry. No difference can be done in between the warm-up and printing stages.

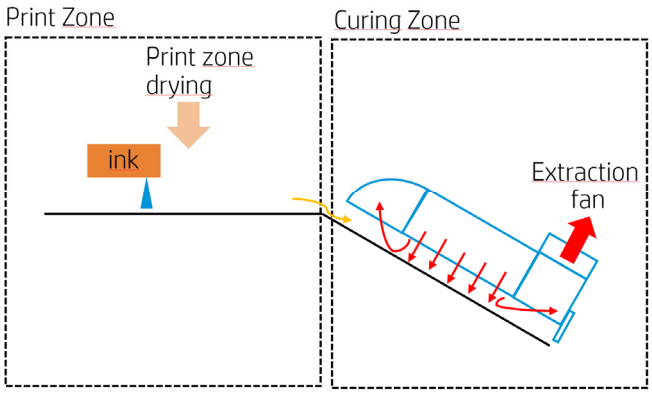
- Heating elements where the extraction is needed and used only to enable the condensation of the evaporated solvents during the printing process. No variable extraction in warm up process to heat up, specially, the print zone.

- Heating elements where the extraction level is set up to do two things at the same time; enable the condensation and regenerate its heat to warm the print zone. No variable extraction in warm up to not cut the heat up of the regeneration system. Only variable extraction to maximize condensation in high saturation plots.

Our proposal is to use the active extraction system and its level to optimize the warm-up of the system and the power usage of the curing module.

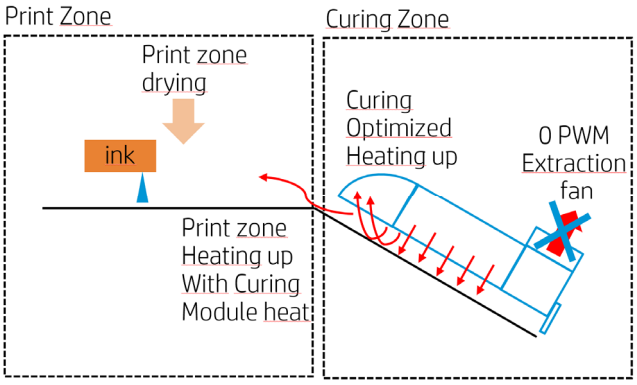
Description

In the *sketch1* we can see the cross section of a latex printing system with its heating element. During the printing process, we first put ink on the medium and apply moderate heat (35-45ºC) with the print zone drying to fix the image. Once the plot exits the print zone, it enters the curing zone whereby blowing hot air on the medium (80-110ºC) we evaporate all the remaining water and solvents and we form the latex film. There is the need to extract the evaporated air and expel it outside the system with the Extraction Fan. To start the printing process, we need to warm up and keep at temperature two heating systems, the print zone drying and the curing module.



Sketch1: traditional x-section of a latex printing system

In the *sketch2* we can see how we can optimize the heating up of the system by switching off the extraction fan at warm up and inverting the fluxes towards the printzone; Print Zone is heated up with the help of the flow that is going from curing to print zone. Curing module is optimally heated up because with the same amount of Power we are recirculating more air and having less losses.

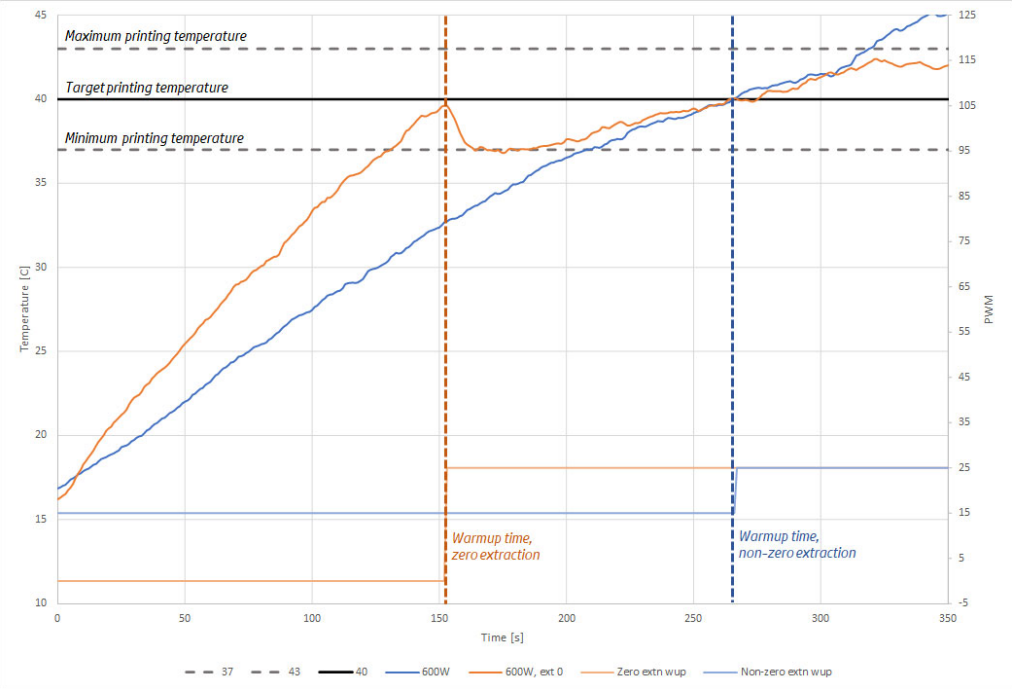


Sketch2: Optimized extraction level for warm up

During the printing process, if the extraction fan PWM is set in a level in between 0 and the nominal one, the power consumption of the system can be optimized as well. Normally we need for instance an Extraction PWM level of 40 PWM for high ink plots that gives a power consumption of 2000W. In low ink plots, by reducing the extraction level to 30PWM the power consumption is reduced to

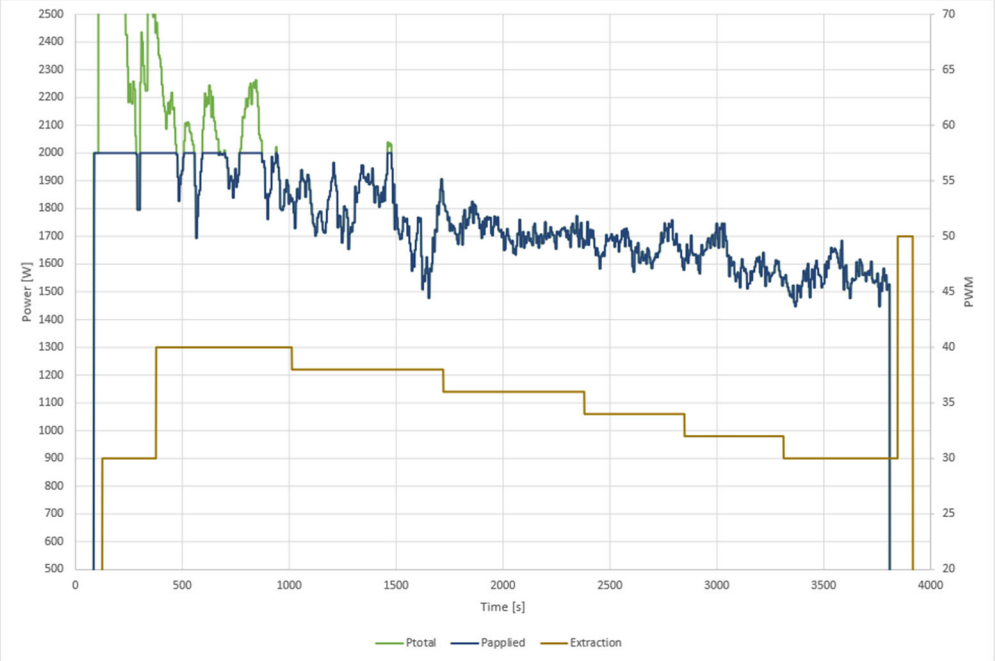
1500W. The extraction level in high ink plots cannot be reduced because condensation can occur In the printzone and also the curing capability can be reduced because of higher saturations inside of the curing module.

In the *graph 1* we can see how the warm-up curves of the Print Zone with or without extraction:



Graph 1: Print Zone warmup with or without extraction

In the *graph 2* we can see how the Curing Zone power consumption varies with the extraction level.



Graph 2: Curing zone power variation with extraction level

Advantages

This invention has the following advantages:

- Reduce warm up time up to 50% because of the curing flow going towards the printzone in the warmup state.
- Have a control of the curing flows in order increase recirculation and reduce power consumption of the heating elements.
- Allow the designer to perform a Cost reduction in isolation Hardware in the case that the warm-up time was already under reasonable times.

Disclosed by Albert Franco, Cara Birschbach, Ignasi Bonjoch, HP Inc.