HIGH PRECISION VIB AirTech$^{Plus\ 6}$ WATER MOISTURIZATION SYSTEM IN OPTILOAD TWINLINE IN KVARNSVEDEN PM 12

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1. INTRODUCTION

Development of water spray technology suitable for use together with new multinip calenders has been on-going for several years. One of the starting points of this development was on-machine SC-B paper making lines in Europe. There spray moistening was used relatively close to the calender but drop marks on paper were observed. This led to the development of spray nozzles and technology, which reduce the droplet size by half or even more.

First this VIB AirTech$^{Plus\ 6}$ fine spray technology was introduced to more recent SC-B paper making lines, for example to UPM Steyrermühl PM 3. The first SC-A paper making line equipped with this fine spray technology was GNP Millinocket PM 11. In that production line, water sprays are used on the both sides of paper near an on-machine 10-roll OptiLoad multinip calender.

The development of water sprays after Millinocket PM 11 has been focused on better support of the web at the spraying zone in high speed machines, on improvements of air and mist handling in the spray area and on positioning of the water spray units inside the calender, not just in front of it.

New materials and manufacturing development made it possible to improve the accuracy of the nozzle body. The special titanium covered air water nozzle, presented in figure 1, is the outcome of this research.

Figure 1. Micro drop^{plus} nozzle

With the Finite Element Method (FEM) is was possible to optimize further the nozzle characteristic and air flow, to stabilize the spray cone even on high web speeds over 25 - 35 m/sec. (1500 - 2000 m/min). In figure 2 is shown the Phase Doppler Particle analysis of the particles in the spray pattern.

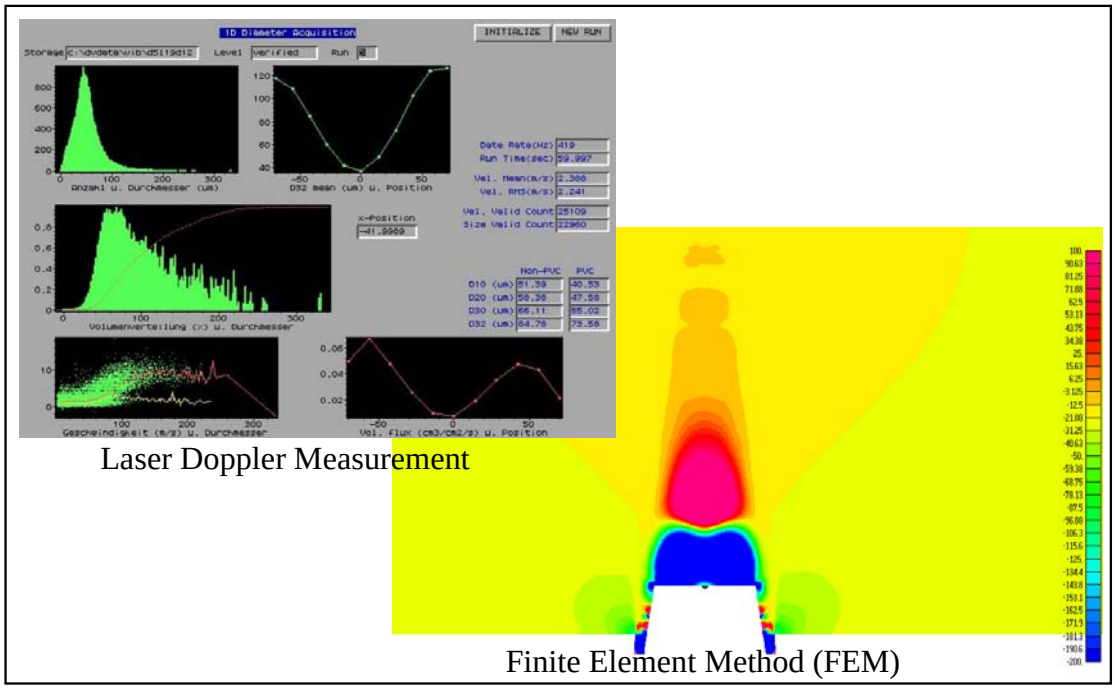

Figure 2. Laser Doppler measurement and FEM calculation of spray nozzle

The control capabilities for each nozzle were improved by precise calibration of the 6-bit digital block. Today the flow of each controlled spray nozzle has bit accuracy of 0.05 l/h. Vacuum protected digital valve blocks and water supply lines assure, even under on/off conditions for an off-line OptiLoad, a droplet free moisture application with finest linear control. The shut off function of the digital valve blocks allows splicing of a new reel of paper.

The absolute linear flow characteristics of the 6-bit technology controls the moisture with zero hysteresis in MD and CD for in calender remoisturization.

The most recent start-up of high precision VIB AirTech$^{Plus\ 6}$ water moisturization system is at Stora Enso Kvarnsveden PM 12 and happened at the end of 2005. Water moisturization units are used in the two off-line OptiLoad TwinLine calenders. This start-up has been extremely successful and VIB AirTech$^{Plus\ 6}$ water spray system has been in use since the first day of the production.

To succeed in Kvarnsveden PM 12, a lot of pilot work had been done in R&D centers of VIB GmbH in Maintal, Germany and in pilot plants of CTC in Raisio, Finland and at Metso Paper Järvenpää, Finland.

The main benefits of using VIB AirTech$^{Plus\ 6}$ fine spray technology together with OptiLoad TwinLine calender are extremely good moisture profiles both entering and exiting the calender, good reel hardness for high efficiency winding, low paper blackening, high paper surface density of paper and high paper gloss. These results are achieved both in the pilot machines and in production scale in Kvarnsveden PM 12.

2. PILOT TESTING OF VIB AirTech$^{Plus\ 6}$ EQUIPMENT

Testing of VIB AirTech$^{Plus\ 6}$ water spray technology for Kvarnsveden PM 12 project was done both in CTC Research center and in Metso Paper Järvenpää pilot facilities. The lay-out of CTC research calender is shown in figure 3. In the off-machine OptiLoad TwinLine concept, the bottom side of base paper is moistened before calender and the top side of the paper is moistened between the two calender stacks.

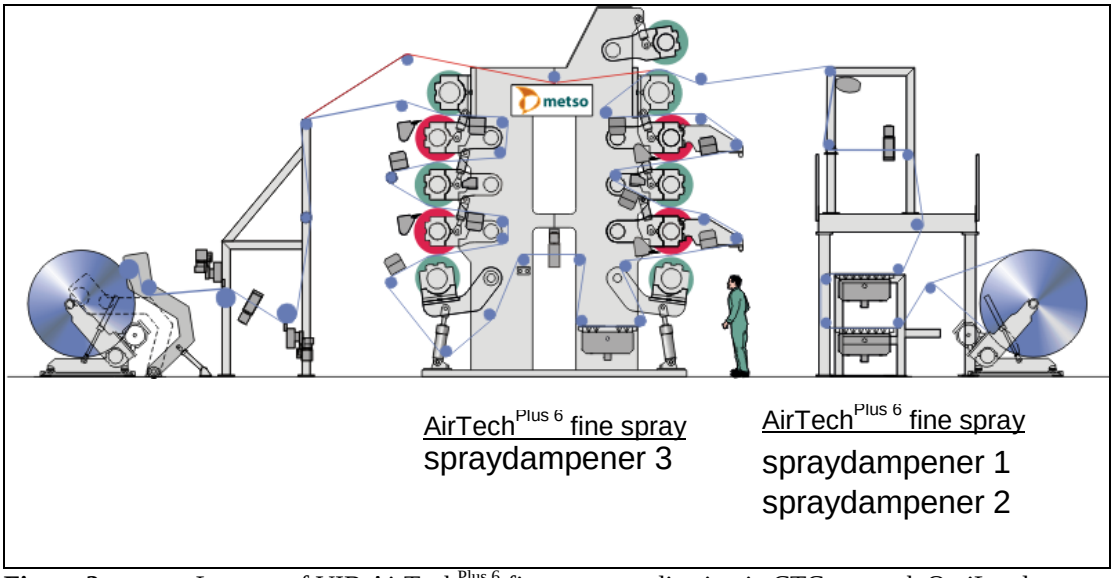

Figure 3. Lay-out of VIB AirTech$^{Plus\ 6}$ fine spray application in CTC research OptiLoad calender

In CTC the main focus of the work was related to the achieved benefits on paper quality and in printability. In Järvenpää the focus was on improvements on spray quality with all new details, found by carefully analyzing past projects.

The spray moistening gives a large process window to find the optimum combination of paper properties. Based on pilot results best achievable paper gloss and PPS of a SC base paper with correct final moisture level (5.5%) and with tolerable blackening (<55%). With the moistening technology 5 – 15 % units of paper gloss and 0.08 – 0.14 μm of PPS roughness can be achieved compared to traditional SC calendering without moistening. These results agree well with earlier experiences on SC calendering [3 - 5].

The spray moistening was fine tuned based on the experiences learned from past projects. A clear target to reduce CD moisture variation to half from previous installations was set and achieved on pilot machines (Fig. 4). On-line VIB AirTech$^{Plus\ 6}$ spray moistening gave the same moisture variation level at 8 – 12 % moisture content, which is normally obtained by over drying to 3 % moisture content in paper machine.

The same low target CD variation level was set for production scale moisturization in Kvarnsveden PM 12.

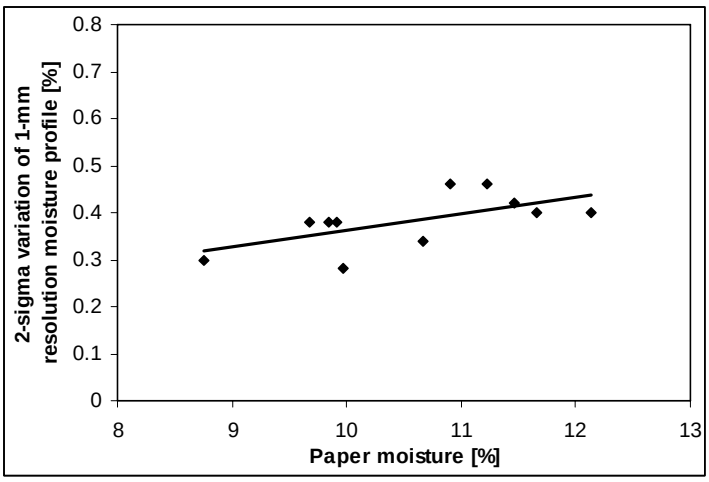

Figure 4. 2-sigma variation of high resolution moisture profile after VIB AirTech$^{Plus\ 6}$ spray moistening of SC base paper at 4 % moisture content.

3. INSTALLATION OF KVARNSVEDEN PM 12

Figure 5 shows one of the the two Kvarnsveden PM 12 off-line OptiLoad TwinLine calenders. Both the calenders include the fine spray VIB AirTech$^{Plus\ 6}$ system (fig 6). The system is designed for up to 1500 m/min operation. The paper web is supported by guide rolls in spraying areas to ensure both good runnability of the calender as well as low CD moisture variation.

Figure 5. Kvarnsveden PM 12 OptiLoad TwinLine calender

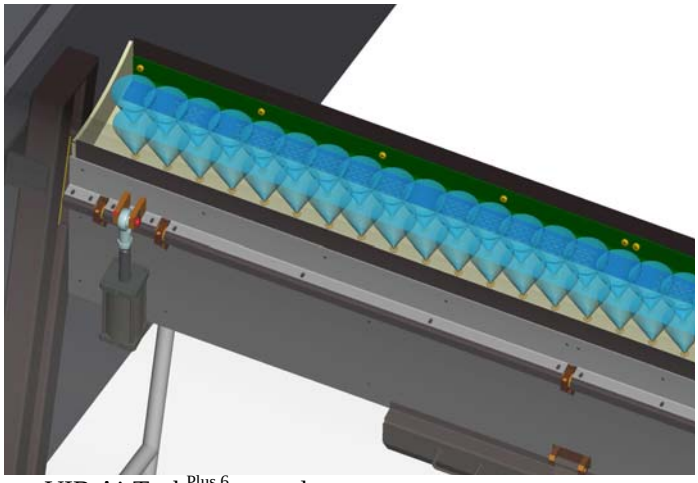

Figure 6. VIB AirTech$^{Plus\ 6}$ spraydampener

Typical water amount used in the system is 2-4 gsm water flow of the first spray and 2-3 gsm flow of the second spray. The actual amounts are controlled based on moisture scanner measurements in front of first nip and after the calender.

4. VIB AirTech$^{Plus\ 6}$ SPRAY PERFORMANCE IN KVARNSVEDEN PM 12

To verify the work done on pilot facilities a test was performed in the Kvarnsveden PM 12 calenders. The system was run with equal water flows as tested with pilot machines. In the first case, manual controls where each nozzle has the same set point was used. In the other mode, moisture controls were used. Thus, CD and MD set points were calculated based on measured on-line moisture values.

Figure 7 shows 2-sigma moisture variation obtained in production scale. The test shows that extremely good moisture profiles are achieved both entering and exiting the calender. Also, peak to peak moisture variation is below 0.6 % entering the calender at 10 – 11 % paper moisture content. After the calender at reel, moisture variation is almost undetectable.

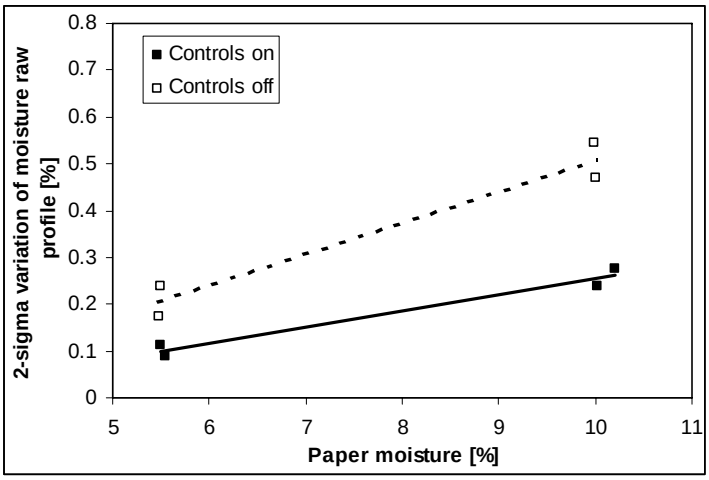

Figure 7. Moisture 2-sigma variation with VIB AirTech$^{Plus\ 6}$ fine spray application, both in manual control and CD/MD automatic control in Kvarnsveden PM 12 OptiLoad TwinLine calenders.

The collection of single high resolution QCS profiles, verifies the observation of extremely flat moisture profiles. Peak to peak moisture in far less than 1% entering the calender and exiting calender this variation is all most undetectable as seen in figures 8 and 9.

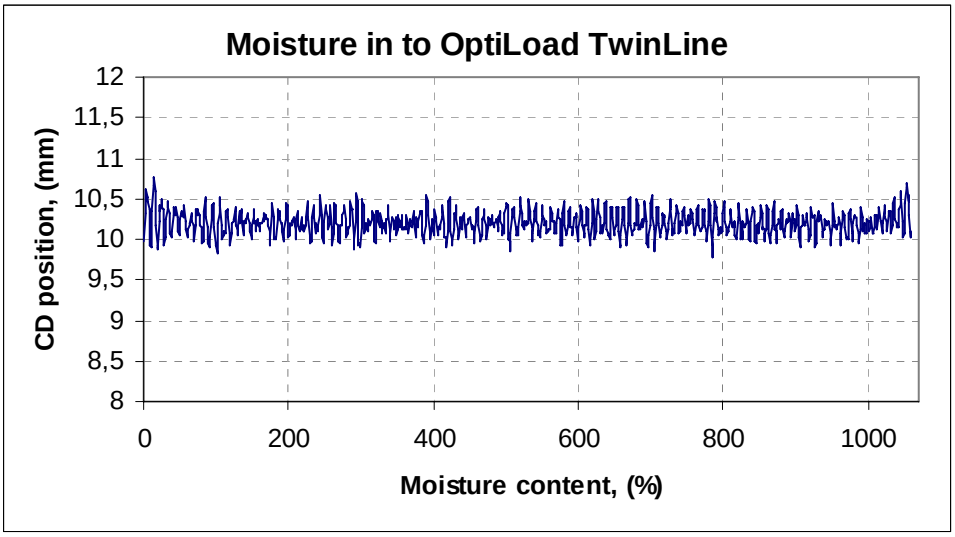

Figure 8. Performance of VIB AirTech$^{Plus\ 6}$ fine spray application with CD/MD automatic control on.

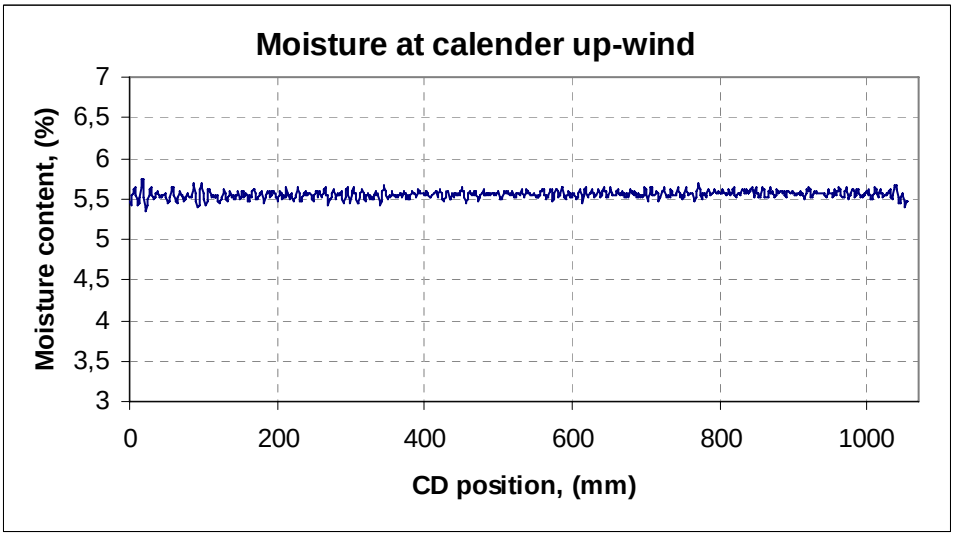

Figure 9. Performance of VIB AirTech$^{Plus\ 6}$ fine spray application with CD/MD automatic control on.

On paper quality the performance of VIB AirTech$^{Plus\ 6}$ water spray system has been tested as well. Good results without drop markings as seen on pilot testing phase are transferred one-to-one to this 11-m wide paper machine in Kvarnsveden PM 12. Due to meeting the expected performance of the VIB AirTech$^{Plus\ 6}$ water spray system, it has remained in use since the first day of production.

5. CONCLUSIONS

Water spray moistening technology together with modern multinip calendering has proven to give extremely good paper quality in production scale in Kvarnsveden PM 12. On-line moistening gives a large process window, which renders possible a new level of SC paper quality in high speed paper making process. The invention of the Titanium micro drop nozzle in connection to the calibrated 6-bit valves has made that extremely accurate moisture control possible. Development work with the TwinLine calender together with the VIB AirTech$^{Plus\ 6}$ spray moisturizers has led to extremely good moisture profiles without any drawbacks in the process.

6. REFERENCES

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