When rolls really matter
Tips for optimal nip dewatering

Hello, dear papermakers!
Give us facts – that's quite rightly what customers demand from TASK. Just like in our latest case in which a customer noticed irregular CD moisture profiles in his felts over a long period of time. This is a problem that is regularly discussed while undertaking our customer service and one that certainly needs to be addressed when it occurs. After all, in most cases the CD moisture profile can also be observed in the sheet! As always the question is: Where does the difference in water content come from? Clarity comes from nip profile measurement.

As you know, Heimbach customer service personnel regularly check felts running on the machine, measuring and calculating CD moisture profiles. **Ideally each position should be measured more than once over the lifetime of a felt.** In the case of this particular customer our field service colleague measured the relevant data and handed the results to us. My colleague Janek Schiefer and I set out together in order to follow up.

Valuable initial discussion

We initially discussed the issue on site with the mill operations manager who reported interesting occurrences: While both 1st and 2nd press felts operated without problems, in the 3rd press **the CD moisture profile was uneven again and again** (see figure 1). On a machine with a width of 4.5 metres the areas around the edges (front side (FS) and drive side (DS)) clearly showed more moisture than in the centre. This was despite the fact that the press section had been aligned by specialists prior to our visit at the request of our customer. We could therefore establish right from the start: **The two press rolls are aligned perfectly in parallel** so that "crossed alignment" could be excluded as a source of the fault.

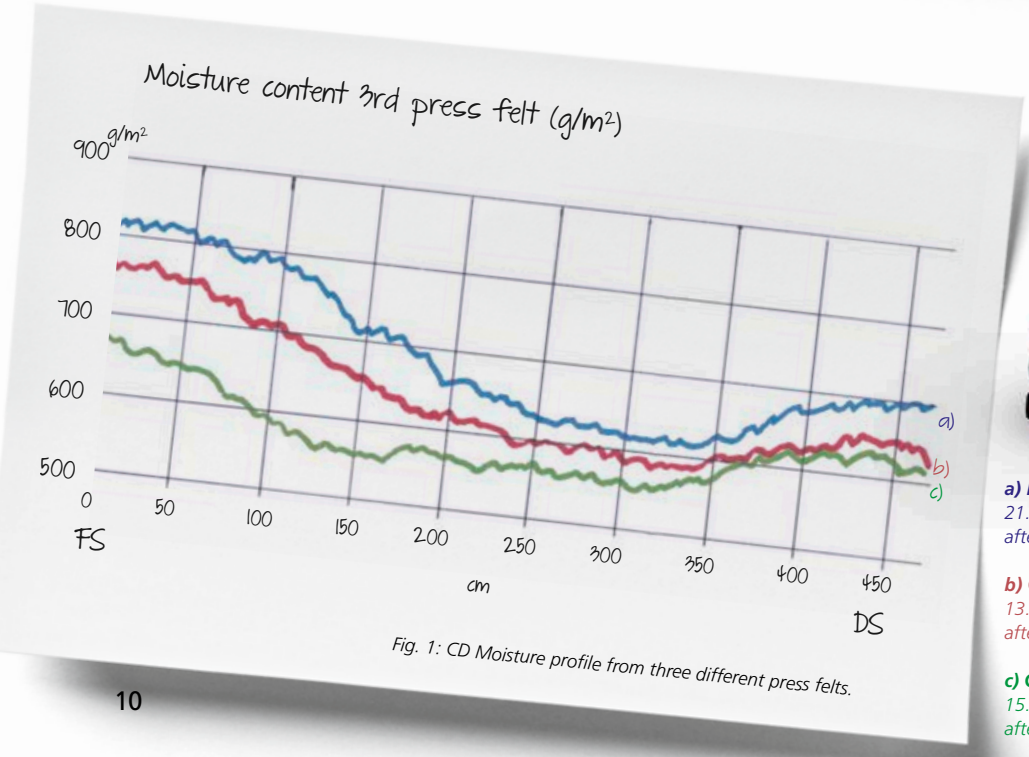

Fig. 1: CD Moisture profile from three different press felts.

a) Heimbach, Atromaxx.CONNECT
21.10.2016-29.11.2016 = 39 Days
after Nip, Average: 700 g/m².

b) Competitor A, unknown
13.04.2017-10.05.2017 = 27 Days
after Nip, Average: 650 g/m².

c) Competitor B, unknown
15.03.2017-29.03.2017 = 14 Days
after Nip, Average: 594 g/m².

Photo 1: Measuring membrane and "multiplexer" in close-up.

Photo 2: Janek Schiefer pick ups data with the "multiplexer".

Investigating the causes

It was equally clear that the fault had **nothing to do with any of the machine clothing**. Figure 1 shows the moisture profiles of three press felts from different clothing suppliers (water content in g/m² felt). Besides our Atromaxx.CONNECT felt a competitor's products had at other points in time been installed in the same position. The result was the same, however: differences in moisture content in the cross direction. We therefore concluded that the **cause of the problem must be in the configuration of the press** – even though, as already mentioned, parallel alignment had been checked. At this point the nip profiles had to be investigated further. So we set to work with our measuring equipment. Here, as always, the principle **"safety first!"** is paramount. After all, there is **a drop of four to five metres under the seam felt**, and you can never be sure that it is strong enough to support a fall.

Hightech unwrapped

Dressed in our safety gear, we were now ready with our technical equipment at hand. In the case of nip profiling, by the way, this consists of sophisticated measuring tools that are really fit for purpose: Besides using special software on high-performance laptops we also use **a "multiplexer" which allows us to pick up data from so-called "sensor membranes"** (see photograph 1). This device, a kind of plug unit, is equipped with contact points which are connected to the membranes. For each customer we have a **specific measuring file**, already created with the aid of a calibrating station, which is installed on each of these measuring membranes. The computer records all raw data which can be read immediately on-site. This allows us to show **force and nip area to the customer on the day of visit**. Precise nip lengths are measured later in the office using the specialist software. This is a crucial processing step and experience in nip profile measurement plays a major part here.

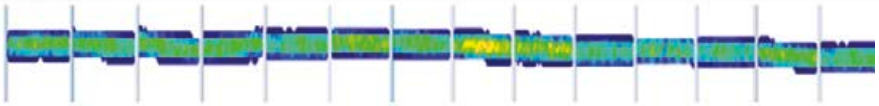

Fig. 2: A good thing – uniform nip lengths.

Special membranes for a special service

However, the most important role in this on-site measurement is played by the sensor membranes, which are **prepared with a special fluid**. This fluid inside the membrane consists of several polymers that change their electrical resistance depending on the force applied to them. The computer software in turn records and interprets this resistance. **Obviously the measuring membranes must be able to withstand great pressures** but at the same time register the minutest differences – robust and sensitive rolled into one. During application the following must always be observed: **The membranes must be placed exactly between the two rolls** in order to ensure that precise nip measurements are recorded. When everything is prepared the press rolls are brought together and pressure is thus exerted on the membranes. Janek and I went on to pick up the data from all 14 membranes (Photo 2). You can see the result in the original image (Fig. 2).

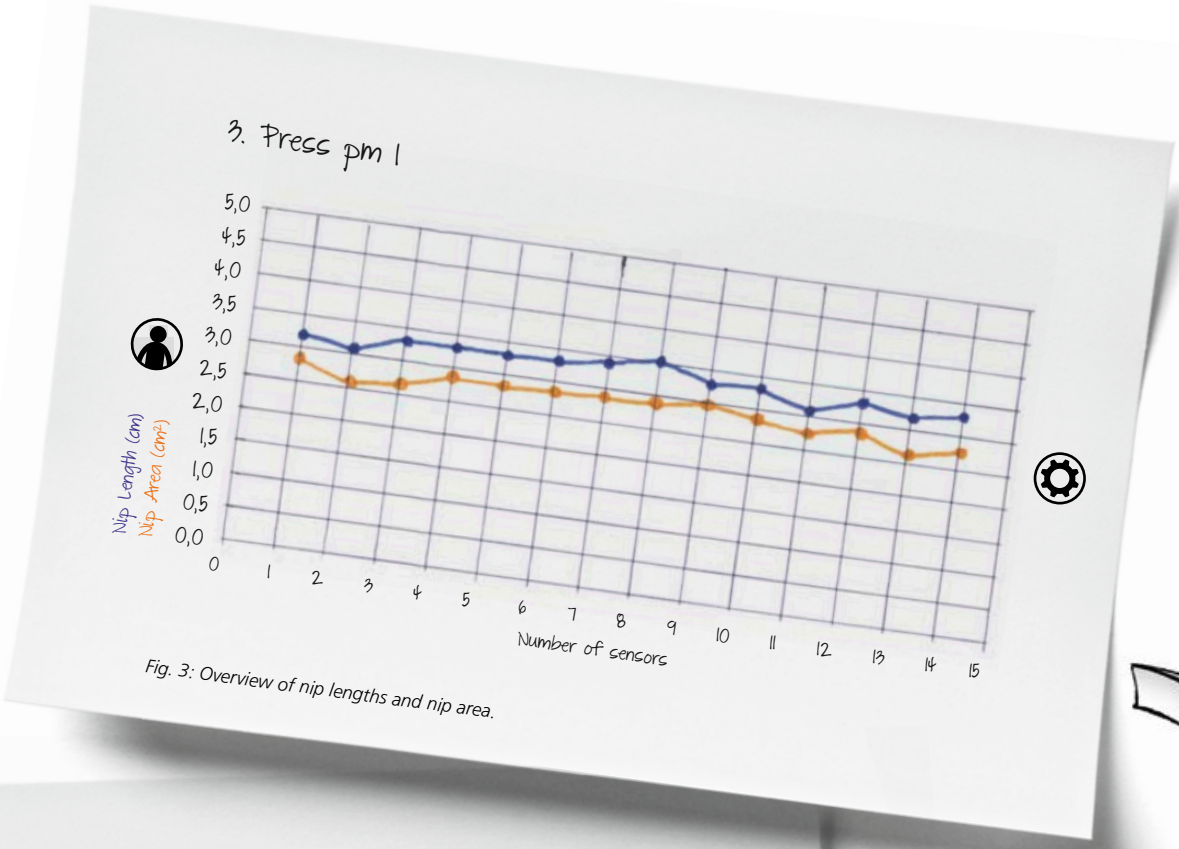

Fig. 3: Overview of nip lengths and nip area.

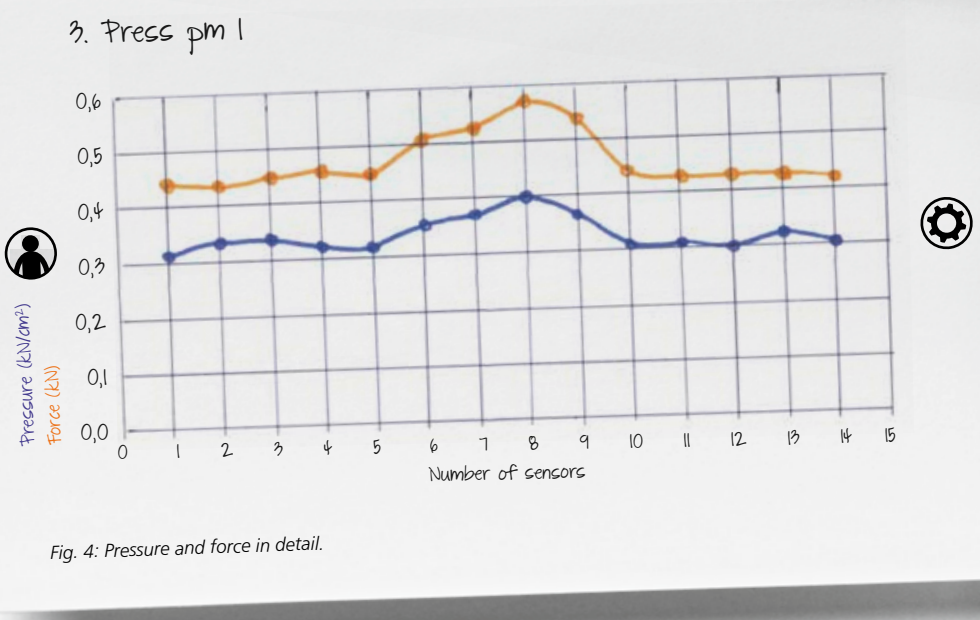

Fig. 4: Pressure and force in detail.

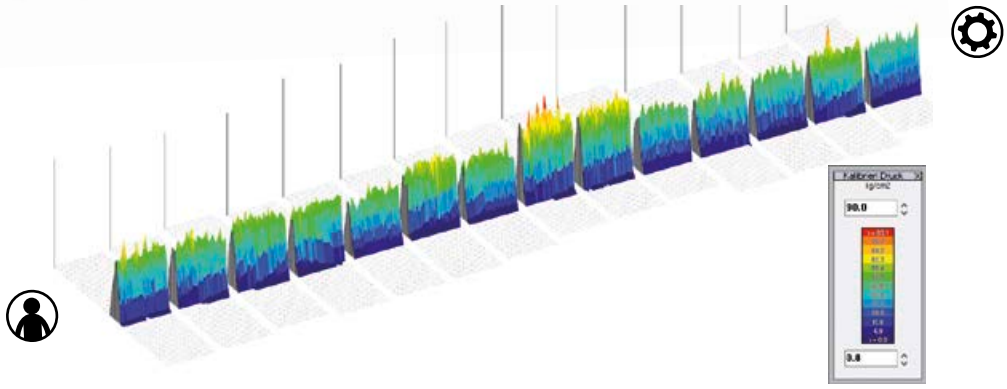

Fig. 5: Original image of the unequal force exerted.

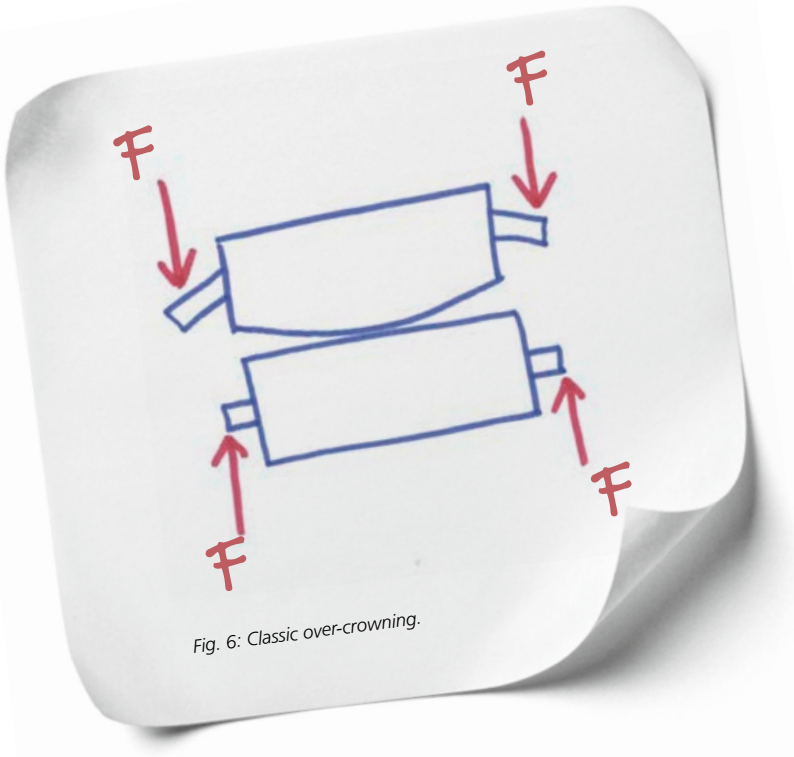

Fig. 6: Classic over-crowning.

Straight facts

This image represents the nip lengths which were **remarkably uniform across the entire machine width**. The values from the 14 membranes are represented for you as line diagrams in figure 3: The nip lengths in blue, the area in orange. Just to clarify: The length is exactly the distance in MD where the rolls meet; the width is limited by the measurement area. **This results in what we describe as the nip area (in cm²), which shows where the rolls press together.** Since the lengths (and therefore also the area) were all in order we then had to focus our attention on force and pressure – **also very significant parameters!** We frequently point out to customers that conclusions based merely on nip length (and area) are not sufficient. Facts cannot be considered to be reliable unless force is taken into consideration.

Unequal force distribution

Simply put, in the area of higher pressure there is no change in nip length any more, which means that misinterpretations are possible. **For this reason, and in order to avoid this, we at TASK always measure area – and force!** The important thing is: we establish the actual force that has been exerted in order to calculate the pressure from it (pressure = force/area). We have produced a further line diagram for you showing this (Fig. 4): Here you see the pressure in blue (kN/cm²), with the force (kN) shown in orange. The facts then became clear: **With equal nip length the pressure (towards the centre) has increased!** Thus we detected an increased effective force. This can also be seen in the original image (Fig. 5), which shows in graphic form that the force in the central area was significantly higher than at the edges (FS/DS).

Correct crowning

These insights correspond to the CD moisture profiles of the felts that we showed at the beginning! **Clarity achieved – thanks to measurements!** We were able to prove that the press roll showed over-crowning (Fig. 6) – a fact that previously had not been considered. Our customer is now going to pass on the results of our measurements to their roll manufacturer who will then calculate how the over-crowning can be rectified. The aim is of course a 100% parallel roll gap that guarantees the best uniformity. What this ultimately means for you, dear papermakers: When rolls are perfectly crowned the surfaces of your press felts can be used to their full potential, in other words: you achieve maximum dewatering! **In this way you extract the optimum from the nip** – and that is ultimately the aim if you want the sheet to leave the press as dry as possible.

Your Paper Pete