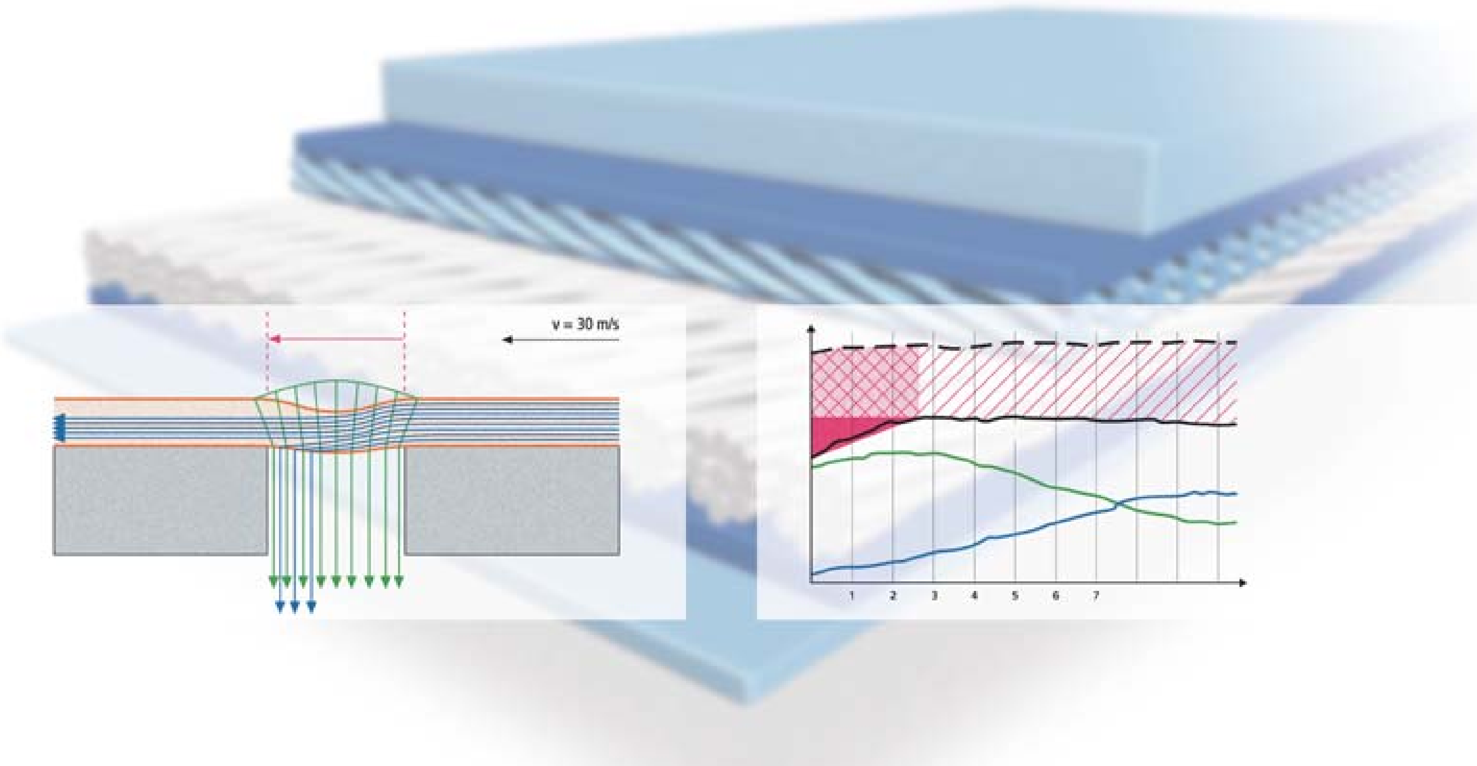


Press Release

How can Energy Savings be increased by Press Felts?

O. Kääpä (Dipl.-Ing.) Vice President Sales, Heimbach GmbH & Co. KG, olli.kaapa@heimbach.com
A. Hüttner, Strategic Product Manager Pressing, Heimbach GmbH & Co. KG, andre.huettner@heimbach.com

How can Energy Savings be increased by Press Felts?

Introduction

Efforts towards energy savings have affected the whole paper industry and involve all aspects of the production process. Included are not only the major "inevitable" energy users, the dryer sections, but also other energy-relevant areas such as the forming and press sections.

The following article aims to highlight energy connected facts from the area of press dewatering and the press clothing. In addition to the obvious and direct possibilities of savings, the complex net of indirect energy connections is examined.

As well as the ecological benefits of energy saving, the increasingly important economic advantages are obvious. The achievement of both combined with an optimisation of the production process and an improvement in sheet quality belongs to the future performance efficiency of Heimbach press felts.

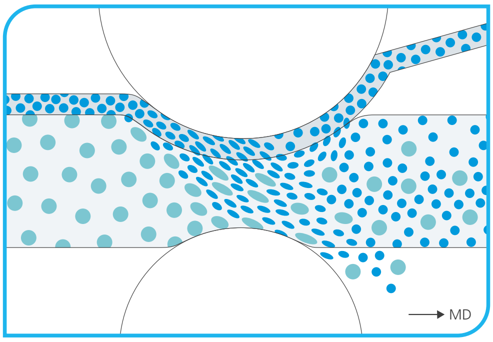
Facts on Energy and Costs in the Press Section

In relation to total paper manufacturing costs the costs of press clothing at <1% are fairly insignificant. However, their significance for the production process, for paper quality and for the subject of "Energy Saving" examined here, goes for both technological and economical reasons well beyond this cost relationship. From this fact it is clear that a low initial purchase price for the clothing is less important than the level of its efficiency. The felt which best pays for itself by fulfilling all the required technical parameters is the most economical – independent of its purchase price. This case is made here for Heimbach Felts.

The Role of the Press Felts in the Reduction of Energy Consumption

1. Influence of Felt Saturation on Dewatering

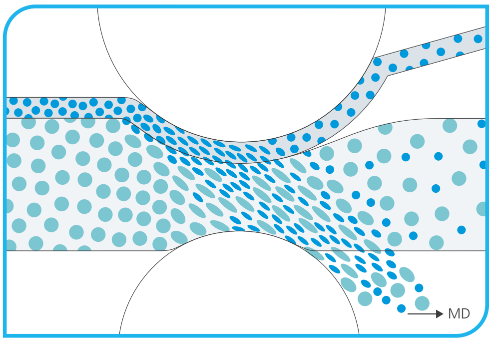
The degree of saturation of the felt before entering the press nip substantially influences the dewatering efficiency. Only an adequately saturated felt can achieve the maximum dewatering. With inadequate saturation the dewatering pressure in the nip is not sufficient to remove a large volume of water (from both saturation and the sheet) rapidly through the felt immediately after the nip. Instead, the insufficiently saturated felt is merely "enriched" by the water volume from the sheet. This amount of water remains in the open void volume of the felt (Ill.1) and can only be removed by the Uhle Box. As a result nip dewatering is not initiated. Additionally the risk of rewetting is increased (Ill.1).



Ill.1 Insufficient saturation: Uhle box dewatering

With the correct level of saturation (Ill.2) the capillarity of the felt structure is already optimally "pre-activated" before entry into the press nip – and depending on felt type now ready for nip dewatering.

If the activation only commences within the press nip, the necessary time for the dewatering process is missing. Time frame required: at 1500 m/min and a normal roll press about 1/500th of a second.



Ill.2 Optimal saturation: Nip dewatering

Advantage for Energy Balance

Optimal saturation –> maximum dewatering = highest dry contents

Rule of thumb for saturation, eg. graphic papers: water component approx. 40% of felt weight, with heavier felts possibly somewhat less, but on no account to be run too dry.

2. Uhle Box or Nip Dewatering?

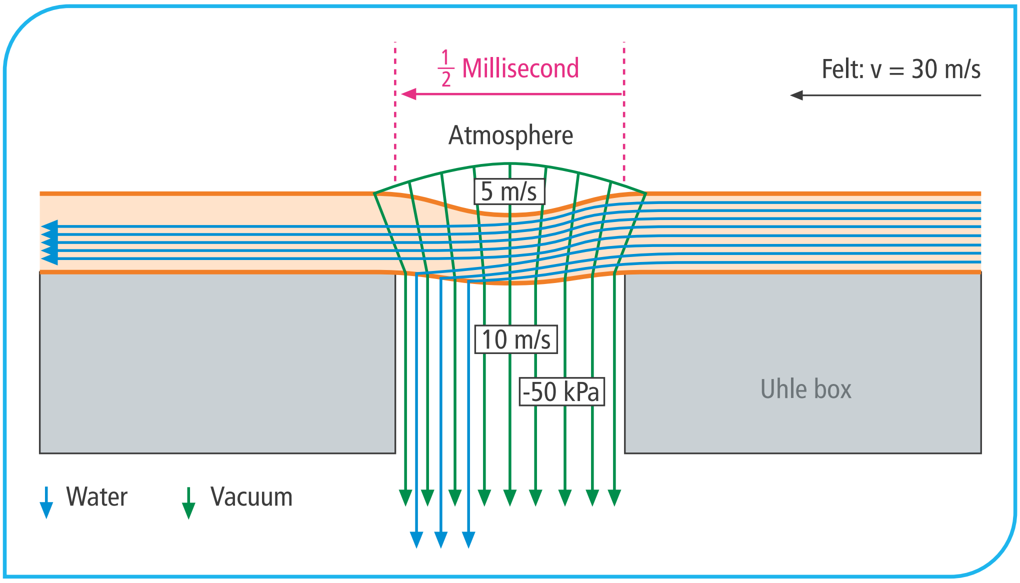
The laws of physics discourage Uhle box dewatering on fast running machines: there is just not sufficient time available. For example: at 1800 m/min with two Uhle boxes each 15 mm wide the total dewatering time is round 2 milliseconds. The initial objection: "…in the nip (of a roll) press it is similar". However, in contrast to the nip situation the water in the horizontally running felt has to be removed at an angle of 90° vertically into the slots of the Uhle box – and that at an air velocity of only 10-15 m/sec (Ill.3). In order to achieve adequate dewatering in this way more than two Uhle boxes combined with extremely high vacuum levels would be necessary. Result: higher rather than reduced energy consumption – and that without any increase in the dewatering! Explanation: at a Uhle box vacuum level of around 50 kPa the dewatering pressure is at 3 kN/m. In the nip with 75 to 1200 kN/m it is about 25 to 400 times higher.

This confirms the dewatering system for fast running machines in favour of nip dewatering. In addition the complete and intensive water flow through the felt creates a continuous felt cleaning. The Uhle boxes provide only – at significantly reduced vacuum – a residual dewatering combined with felt conditioning. In many cases it has been shown that, where there is successful nip dewatering, the Uhle boxes can be removed entirely.

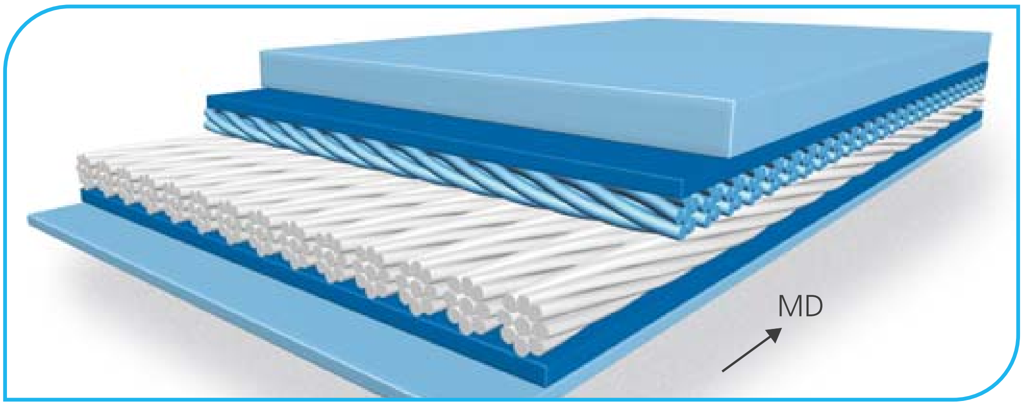
3. Nip Dewatering – the Optimal Clothing

The achievement of maximum nip dewatering requires the use of specially developed press felts. The proven non-woven felts from Heimbach (Ill. 4) combine all the attributes required to achieve a high efficiency nip dewatering (Ill. 5).

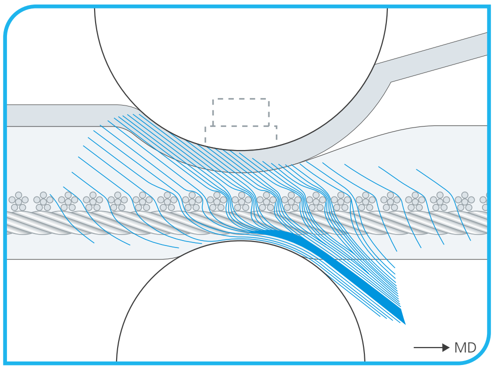
They have proven themselves many times round the world: Recently, the 7,777th ATROCROSS was installed successfully at a major French customer. The experiences made by many successful installations brought nip dewatering to its current highly developed level. In this manner Heimbach has pioneered the way to speeds of 2000 m/min.



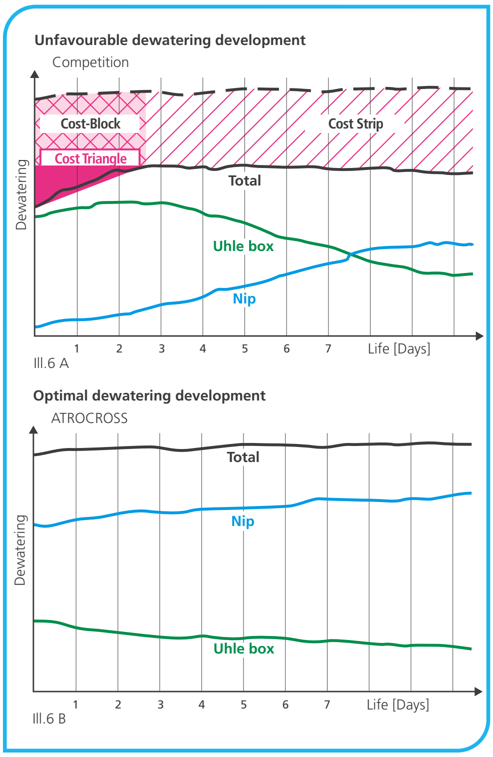
Ill.3 Uhle box dewatering



Ill.4 ATROCROSS felt



Ill.5 ATROCROSS:
Nip dewatering, reduced rewetting



Ill.6 Cause / elimination of "Cost Triangle"

Advantage for the Energy Balance

Maximum dewatering, reduced rewetting = higher dry contents, reduction / elimination of energy for Uhle box vacuum

Case Study "Start-up and Life time Performance"

Already in the start-up phase of a felt energy savings can be made to a significant extent.
In many cases press felts require 2-3 days for the full activation of their dewatering efficiency. In the case of the measurement shown in Ill.6A (newsprint), nip dewatering developed late with a long activation period and then remained only average over the felt life. The slow increase in total dewatering causes a "Cost Triangle" which shows up in poor energy utilisation and reduced production. In addition the relatively low water removal through the Uhle boxes during the whole felt life prevents the highest level of total dewatering from being achieved.

In the measurement of the same position, after installation of an ATROCROSS "fast starter" felt (Ill.6B), nip dewatering at a high level commences immediately after the start. After continual increase the level is maintained for virtually the whole felt life. The Uhle boxes remain at a low level and assist in residual dewatering.

Calculation of the economic advantages:
Measurement 6A: During the 2.75 day start-up phase the average speed at 1632 m/min was 66 m/min below the later achieved maximum

speed of 1698 m/min. This caused reduced production of 115 tonnes in the 2.75 days with a sales value of around EUR 63,000.

Measurement 6B: Here over the same period with ATROCROSS the average speed of 1713 m/min was only 12 m/min below the later achieved maximum speed of 1725 m/min. The result was reduced production of only 21 tonnes with a value of about EUR 11,500 during the 2.75 day start-up phase.

That means in comparison that the Heimbach felt solely as a result of the immediately almost on maximum level starting total dewatering in the first 2.75 days was able to achieve an additional production of 94 tonnes with a value of about EUR 51,500 = "Elimination of the Cost Triangle".

Furthermore the "Cost Block" is also eliminated (see Ill.6A). This was achieved by the generally higher level of start-up dewatering and therefore of the dry content with the felt in Ill.6B. This gave the felt an 81 m/min higher average speed during the 2.75 days .The outcome was a production increase of 140 tonnes with a value of approx. EUR 77,000.

Taken in total, the facts in Ill.6B show that alone in the start-up phase an increase in production of 234 tonnes or EUR 128,500 was obtained. And finally the felt also ensures the elimination of the "Cost Strip", i.e. the life-long low dewatering level (see Ill.6A). In comparison with this the high dewatering level in Ill.6B brings a permanent additional speed of about 27 m/min and with it an additional daily production of approx. 16 tonnes or EUR 9,000.

To recapitulate, these impressive economic advantages are based on the four described technical improvements in the production process: correct felt saturation, adjustment to nip dewatering, and for this the appropriate clothing, i.e. fast start together with maximisation of dewatering by ATROCROSS.

Advantages for the Energy Balance

Fast start to highest level –> more dewatering = optimal utilisation of start-up energy and a production increase in the start-up phase of 234 tonnes or EUR 128,500, in total higher dewatering level over the felt life with reduced Uhle box vacua = permanently lower energy consumption resp. daily production increase of approx. 16 tonnes or EUR 9,000

Case Study "Total Dewatering"

The dryer section removes by far the lowest share of water from the sheet, but requires by far the highest share of energy. The following case study of a non-woven felt from Heimbach on a machine producing 45 g/m^2 illustrates that this most cost intensive component can be significantly reduced already in the press section (Ill.7): After the installation of this felt a dry content increase of 1% (= increased by 2.04%) was recorded after the press section. This apparently low increase – because of the clothing change solely in a single position – achieved over the period of a year an enormous steam saving, quantified in Ill. 7.

Advantages for the Energy Balance

Steam saving in the dryers of 5% = 46.2 tonnes or EUR 2,079 = steam saving per year of 16,632 tonnes or EUR 748,440

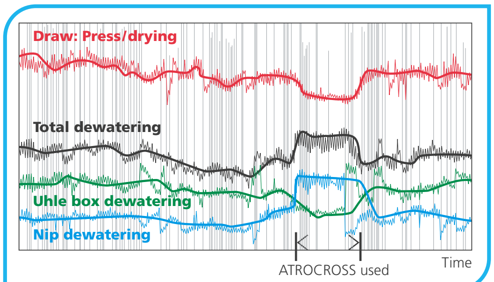
Alternatively the following is valid: If the previous steam usage is applied, then 1% higher dry content or 4% higher production would result. That could bring an increased value of about EUR 8 million.

Case Study "Break Frequency"

The faster the paper machine, the more important is the role of nip dewatering combined with the most appropriate clothing – highlighted in measurement Ill. 8.

Production: 45g/m² wood content, width 10m, 1700m/min	
Daily production (effective)	936 t
Steam consumption per day	924 t
Steam costs per day (45 EUR per t)	41,580 EUR
Dry content plus (after press section)	**+1%** (= increased by 2.04%)
Steam consumption minus (dryer section)	**-5%**
Steam consumption minus per day	46.2 t
Steam costs minus per day	2,079 EUR
Steam consumption saving per year	**16,632 t**
Steam costs saving per year	**748,440 EUR**

Ill.7 Energy saving: Higher dry content, lower steam consumption



Ill.8 Comparison: Dewatering – draw

The long term trend on the previous mentioned machine shows over several installations of other felts comparatively stable curves for felt tension, total dewatering, Uhle box and nip dewatering.

After the installation of ATROCROSS, which dewatered predominantly in the nip, a dry content increase was achieved as a result of the higher total dewatering (see Ill. 7) with a further consequence of this being increased sheet tensiles.

Further advantage: better energy utilisation, eg steam consumption in the dryers (see previous case study and Ill.7).

The measured dry content increase of 1% (Ill.9) amounts to an increase by 2.04% and permits an increase in the wet strength of the sheet by 6%. Simultaneously there was a reduction in the draw.

As a result of these improvements the break frequency was reduced by 97 breaks per year (Ill.9).

Advantages for the Energy Balance

Production time gained = 32.33 hours per year more full energy utilisation of heated dryer cylinders, increased production per year of 1,260 tonnes = EUR 781,200

A matter of course, Heimbach have numerous additional examples on the theme "Energy Savings from Press Dewatering and Press Clothing" which will be reported in forthcoming papers.

Summary

The facts covered in this article and their relation-ships indicate the high degree of complexity on the subject of energy. In addition to the individual

Production: 45g/m^2 wood content, width 10m, 1700m/min	
Production per hour (effective)	39 t
Steam consumption per hour	38.5 t
Steam costs per hour (45 EUR per t)	1,733 EUR
Dry content plus (after press section)	**+1%** (= increased by 2.04%)
Wet tensiles	**Increase of 6%**
Breaks minus	**97 per year**
Time gain (20 min per break)	32.33 hours per year
Increased production (39 t per hour)	**1,260 t per year**
Increased turnover (620 EUR per t)	**781,200 EUR per year**

Ill.9 Energy advantage: Reduced break frequency, increased production

studies of energy saving this article documents two significant results:

One: Positive answers to questions on reducing energy consumption in the press section are substantially determined by the appropriate clothing – and the possible optimisation of dewatering techniques that the clothing permits.

Two: The solution of energy saving problems through the use of press clothing stands in direct conflict with the cost pressures on the clothing manufacturer as supplier of these solutions. This cost pressure hides the risk of a "braking" effect on new developments which are essential if further reductions in energy consumption and costs are to be achieved. Heimbach is grateful to have had the opportunity of presenting here several cases for energy and cost savings.

55/0804GB