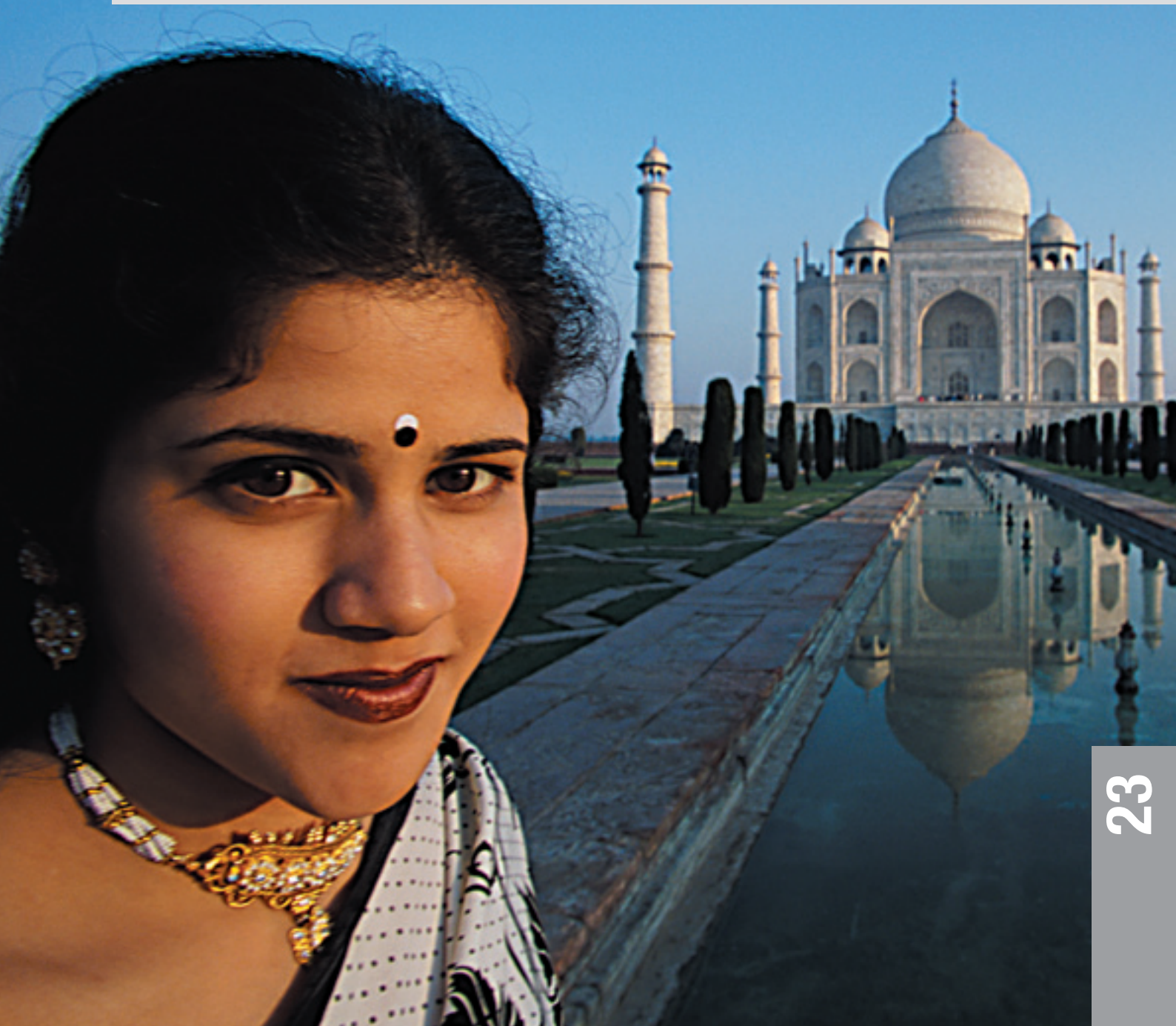
twogether

Paper Technology Journal

India's surging economy I Shandong Huatai Paper breaks another world record I Revolutionary pulping concept



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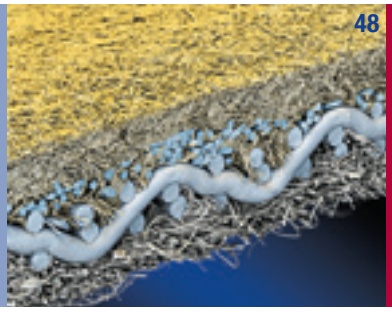

Report

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Miscellaneous

Voith Group news

Culture

Regular features

Dr. Hans-Peter Sollinger
Member of the Corporate Management Board Voith AG and President of Voith Paper

Dear customers,
Dear readers,

2006 was another excellent year for Voith Paper, with numerous new machines and rebuilds that rapidly met their production goals after only a short commissioning and optimization phase.

This issue of twogether magazine reports on some of those startups, for example the extremely successful commissionings of Huatai PM 11 and PM 12 as well as the Guangzhou Paper secondary fiber stock preparation line.

What is the secret of these successes that pay off so well for our customers? The answer lies in Voith Paper's overall system competence. This enables us to support our customers with successful project realization from beginning to end. Our primary goal thereby is to keep project costs as low as possible by minimizing costly interfaces, and to optimally coordinate all process components by applying our comprehensive papermaking know-how.

A significant step in this direction is the new Voith DriveCommand system that optimally integrates process competence and drive automation know-how. The article on page 44 of this issue tells you more about Voith DriveCommand.

Another important aspect is to focus increasingly on operating cost efficiency, primarily with regard to energy, water and waste disposal. Apart from the steep rise in energy costs, freshwater consumption is also a significant cost factor in papermaking today. And above all in Germany, waste disposal costs are becoming unbearable.

To support our customers in this area, Voith Paper has founded a new division dealing with precisely these problems: Voith Paper Environmental Solutions.

Voith Paper Environmental Solutions works out innovative process concepts for environment-friendly resource-conserving paper mills. The resulting high customer benefit in terms of economy sets an important benchmark for the future. Our next twogether magazine edition will address this subject in detail.

In closing, I would like to draw your attention to an important event this spring: ahead07, our international customer symposium for the board and packaging paper industry, will be held from May 9 to 11 in Vienna. I look forward to welcoming you there!

H. P. Sollinger

on behalf of the Voith Paper Team

India's surging economy

With a population of over one billion, a growing middle class with greater purchasing power, skilled labour in the millions, and growth rates exceeding eight percent – the booming Indian economy is competing with that of its north-eastern neighbour China. In fact the world's two most populous nations are now neck and neck in the race for global market leadership. Analysts are already heralding the "Asian century", and at any rate there is no doubt that both India and China have become magnets for the global economy.

The land of Gandhi, so long overshadowed by China, has now advanced to one of the world's top ten economies. According to the World Bank, India's GNP rose in 2005 to 785.5 billion US dollars. More and more foreign investors want to profit from this surging economy in future – including Germany's industries. Direct investments by German companies in India have doubled in only one year, and about 1,500 of them are already positioned there.

After decades of economic isolation, Indian trade is now booming. Exports rose by 23 percent in the fiscal year 2005/2006 to 103 billion USD. Germany is India's fourth most important export customer after the USA, China and the United Arab Emirates.

Trading volume between India and Germany surged by 22 percent in 2005 to 7.6 billion Euro, and may even exceed ten billion Euro in 2006. German exports to India rose to the record level of 4.2 billion Euro in 2005, 28% higher than in prior year, while imports from India rose by 15 percent to 3.4 billion Euro. Above all the German machine industry is favoured with orders from India: machinery deliveries rose by 43 percent in 2005 to 1.5 billion Euro. And in the first quarter of 2006, bilateral trading between the two countries surged even more steeply: German exports rose again by 46 percent and imports by 30 percent!

Our most-quoted example of India's business success is in the IT and call center segments, where turnover rose by 31 percent in 2004/2005 to 28.2 billion USD. But software is not the only area where India has long advanced to international leadership: developments are extremely promising above all in the pharmaceuticals, biotechnology, automobile, aerospace and food industries.

India is well on the way from a one-time Cinderella to the new star of Asia. But the path to stardom is thorny: according to World Bank estimates, 35 percent of India's people still have to live on one dollar or less per day. Above all the rural districts have yet to benefit from India's economic boom, which is of course concentrated on the cities.

Foreign companies in India also have problems to overcome. The economic reforms cautiously launched by the Indian government in the early nineties, as a first step toward global market opening, are still in progress. Because in contrast to the authoritarian Chinese government, the world's largest democracy (as India calls itself) has to reach agreements and make compromises – which slows things down considerably.

According to the World Bank, above all the poor state of infrastructures

and the bureaucratic decision-making processes are hampering India's progress. While new airports and highways are springing up all over China, the world's largest democracy is taking much longer to improve communications. India already has 3.5 million kilometers of roads and highways, but their state of repair is often so bad that average speeds are limited to about 50 km/h.

China's freeway network had already reached nearly 30,000 kilometers by 2005, but India still has less than 2,000 km.

Over the next ten years India will have to completely modernize its infrastructures – highways, railways, airports and harbours, power stations, water supplies and telecommunications networks – at an estimated cost totalling about 440 billion USD. Here again, this is an enormous chance for foreign investors.

Although the Indian elephant is lagging behind the Chinese dragon, some analysts are already betting on India in the medium to long term. A study published by the Deutsche Bank in May 2005 forecasts that by 2020, India's economic growth will be faster at 5.5 percent p.a. on average than any of the 34 national economies investigated. Likewise in the opinion of the US investment bank Goldman Sachs, India may well exhibit the fastest economic growth in the long term.

India has the advantage not only of political stability under democratic conditions, but also of its population structure. According to estimates, in about thirty years India will overtake China as the world's most populated nation. Furthermore, the average age in India is much younger: currently one in three of the population is less than 15 years old, and only five percent are over 65.

A market offering enormous opportunities – also in the paper industry

The many obstacles still to be overcome in India are outweighed by the opportunities. And this also applies to India's paper industry: a glance at the statistics is enough to show up its enormous potential. Global paper consumption per annum is currently 55 kg per head of population on average, ranging from 320 kg in the USA and already 36.4 kg in China – to only 6 kg p.a. in India!

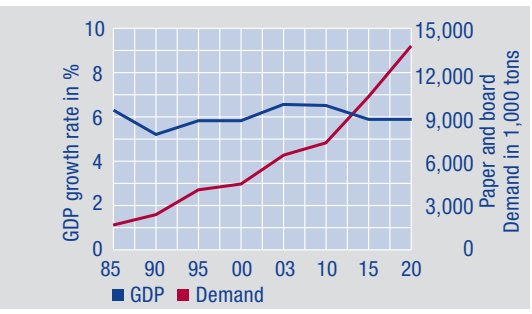
No wonder the experts reckon with such steep growth on this market. Above all the improving standard of living, adoption of western consumer habits, and advances in basic education will lead to far greater paper consumption in India over the next few years. In fact a new class of increasingly prosperous consumers is growing up.

Biotechnology: an Indian growth market.

Modern India – Electronics City Campus in Bangalore.

All the relevant market studies therefore assume an annual increase of at least 6 percent in paper consumption. In other words, paper consumption will likely more than double by 2015 to 12.5 kg per head of population. By then the national paper demand is expected to reach 12.8 million tonnes per annum. According to various studies, India will be expanding its papermaking capacities by five million tons over the next ten years – a lucrative opportunity also for the German paper machine industry.

India: GDP growth rate;
Paper and board demand; Status 2005.



This steeply rising consumption is expected to cover all paper grades, driven by a growing demand from the packaging, printing and food industries. Almost half the booming demand will be for industrial grades. A good many products in India are still sold unpacked in local markets and small shops, but this situation is already giving way to the discounter trend. The discount stores now springing up in India offer foodstuffs and other wares in colourfully attractive carton packages, so that annual growth of 7 percent is expected for packaging papers and board. Annual production of these grades is currently around 3 million tons, but according to the latest forecasts it will reach 4.2 million tons p.a. by 2010 and 5.6 million tons p.a. only five years later.

The steepest growth is expected by experts in writing and printing paper production, with demand more than doubling by 2015. This is not only due to higher demand by the service industries for books, brochures and reports, but also to the growing number of readers. Last year alone, the National Readership Study 2006 reported a newspaper and magazine circulation increase of no less than six million.

India's demand for tissue and toilet paper is also on the rise. Paper napkins, kitchen towels and cosmetic tissues have not been widely used so far in India. And it is sometimes still difficult to find paper handkerchiefs even at drugstores. In the same way as toilet paper or diapers, they are still classified as luxury items – mostly imported either as raw material or finished product – and taxed accordingly at up to 60 percent. India currently produces only 48,000 t.p.a. of these grades, but annual outputs of 122,000 and 251,000 t.p.a. are forecast for 2010 and 2015 respectively.

Every year six million more people in India read newspapers and magazines.

India hardly imports any significant amounts of paper: only three percent of the consumed paper comes from abroad. But this does not apply to newsprint, 91 percent of which is imported. The newspaper publishers prefer imported newsprint because of its superior quality, moreover newsprint in India is relatively expensive due to the high cost of energy and the small production facilities. India's newsprint production is currently about 680,000 t.p.a. and is expected to grow by about 5 percent p.a.

Rapid modernization expected

India's paper industry is still dominated by small to medium size companies. There are currently 666 paper mills in India, of which 568 in operation. Their estimated capacity is 8.5 million tons per year, but domestic production is only 6.55 million t.p.a., because numerous small mills are not working at full capacity.

As in China, but more slowly, the trend in India's paper industry is toward larger and more modern production facilities. With so many small mills spread over the entire country, however, mergers in India are often difficult or unprofitable. But the trend toward large mills will still take effect over the next few years.

In order to enable profitable production and marketing, massive modernization will be unavoidable over the next few years. Numerous production facilities are outdated and no longer competitive on the international market.

For example, the average paper mill in India produces no more than 14,000 t.p.a. – as against the global average of 42,000 t.p.a. Likewise the operating speeds at Indian mills – 200 to 250 m/minute – are far below the global average of 600 to 700 m/minute.

With tougher environmental laws, scarcer raw materials and higher energy costs, India's paper mills will be increasingly forced to invest in modern energy-saving production facilities. Currently, their energy consumption is relatively high at 6.4 to 10.3 MWh per ton of paper produced, as against the global average of 5.0 to 6.1 MWh. And the situation is similar with raw materials consumption: Indian mills use 2 to 2.4 tons of raw material per ton of finished paper on average, as against the global mean of 1.8 to 2.2 tons.

India will not be able to afford this situation much longer: in view of the ongoing deforestation here, timber is becoming increasingly scarce.

Only about 20 percent of India is still afforested, as against 31 percent in Germany, but no sustainable plan for widespread reforesting has been approved as yet.

Tamil Nadu PM 2.

Voith Paper in India

The Voith tradition in India goes back more than eighty years. It was in 1924 when Voith Germany gained a foothold here by selling its first paper machine to Meenakshi Paper Mills in Delhi. And according to the Escher Wyss records, a paper machine was already sold in 1905 to James Stuart in Chittagong, belonging at that time to India.

In those days India was known as the exotic land of maharajas, tigers and diamonds. It was still a British colony, the famous Gateway of India in Bombay (now known as Mumbai) had just been inaugurated, and in 1924 E. M. Forster published his final masterpiece “A Passage to India”. Hardly anyone would have guessed then that this mysterious faraway country where the Ganges flows would develop eighty years later into one of the world’s most promising markets.

Thanks to that early start, Voith Paper is now extremely well positioned in the Indian market.

Already in December 1950 Voith signed an agreement with Larsen & Toubro Limited (L&T) Bombay, India’s leading construction and technology group. In 1960 this was converted into a license agreement enabling L&T to manufacture plant and machinery in India according to Voith designs, whereby critical key components were still imported from Germany.

Over the years Voith L&T supplied a good number of new machines, rebuilds, extensions and recycling lines for nearly all of India’s large paper mills. This includes the fastest paper machine in India so far (at Bilt Graphics, formerly Sinar Mas Pulp and Paper), commissioned in 1996. Almost two decades earlier in 1978, Voith had already delivered India’s widest paper machine so far, to Hindustan Newsprint in Kerala. And in 1995 Voith supplied Tamil Nadu Newsprint and Papers Limited with the world’s fastest and largest paper machine for paper from crushed sugar cane.

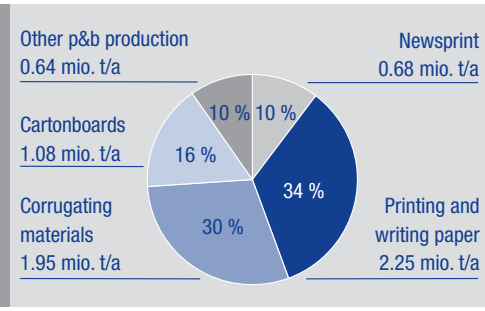
In April 2000 L&T and Voith founded a joint venture with equal participation, and changed the company name to Voith Paper Technology Ltd with registered offices in Kolkata. Voith Paper Fabrics, a Group company with registered offices in Faridabad near Delhi, is moreover market leader in India for paper machine fabrics.

	India	China
Population (mio.)	1,080	1,300
Population growth (%/year)	1.5	0.7
GDP (US$ billion in 2004)	675.0	1,677.0
GDP per capita (US$)	620.0	1,290.0
GDP growth	8.8	6.0
P & B 2005 demand (mio. ton)	7.0	59.0
P & B per capita (kg)	6.5	45.4
Forests (mio. ha)	0.7	1.7

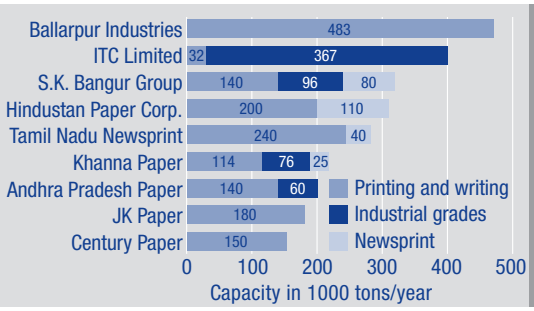
Comparative figures for India and China; Status 2005.

	India	World
Average mill size (tons/year)	14,000	42,000
Average paper machine speed (m/min)	200-250	600-700
Specific raw material consumption (t/d)	2.0-2.4	1.8-2.2
Specific energy consumption (MWh/t)	6.4-10.3	5.0-6.1

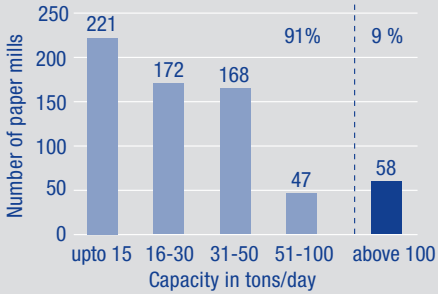
India's paper industry by global comparison.



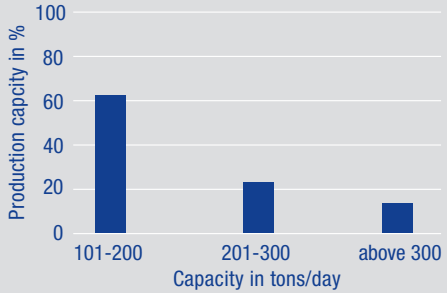
Paper and board production in India.



India's biggest papermaking companies.



Number of paper mills in India (Total 666).



Production capacity distribution of India's 58 largest paper mills.

Under these circumstances, recovered paper will become an increasingly important raw material – and the demand for appropriate plant and machinery will increase. Even now, recovered paper comprises 32 percent of papermaking furnish, with only 40 percent timber. Another 20 percent comprises agricultural by-products such as straw.

There is still great expansion potential for waste paper recycling in India. Currently only about 20 percent of India's waste paper is recovered, as against more than 50 percent in Germany. But India is now making greater efforts to increase the systematic collection of waste paper. This opens up new business opportunities for the paper machine industry in general, and in particular for Voith as the pioneer in modern paper recycling technology and as the leading supplier of appropriate technological systems.

In summary, India's paper machinery market is not growing as rapidly as in China, but it offers great potential in the medium and long term.

Apart from enormous business opportunities, India also offers industrial investors several advantages:

- A plentiful supply of well-trained scientists, engineers and technicians;
- English is widely spoken;
- A politically stable democracy;
- A dependable legal system.

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Guangzhou Paper deinking system – First-class stock for several paper machines

In February 2006, Guangzhou Paper ordered a stock preparation system for improved newsprint from Voith. The state-of-the-art system will replace the existing chemical pulp mill, and will provide several paper machines with 650 t/24h of finished stock made from 100 percent recovered furnish.

Guangzhou city is located in the province of Guangdong South China, renowned both nationally and internationally for its culinary variety and often known as Canton.

During the course of its eventful history since the mill opened in 1936, Guangzhou Paper has grown into one of China's largest and best-known paper producers. As it was common in the past, the mill is located next to a watercourse, in this case the Pearl River. Today, the mill finds itself in the middle of a thriving metropolis. It was, therefore, decided to relocate the entire mill in phases over the next few years in a new industrial zone outside Guangzhou. As part of this relocation project, it was decided to modernize the existing production facilities in order to also reduce pollution.

In addition to its high stock quality, this new line meets all the demanding

MultiScreen MSS fine-screen system.

requirements and strict conditions applying to production plants located in heavily populated areas.

From the signing of the contract to the commercial production, the entire line was delivered, installed and commissioned remarkably quickly in only about 13 months, significantly earlier than originally scheduled.

The order covered not only all stock preparation machinery, but also basic engineering for the entire line. Also included with the order was C&I system engineering, operations planning, as well as erection and commissioning supervision.

The scope of machinery supply is comprised of the following components:

- Two-stage Protector system for HC cleaning with MultiSorter and CombiSorter for holed pre-screening, and integral IC slotted screening with MultiScreen.
- HCH cleaner group for LC cleaning with well-proven EcoMizer technology.
- EcoCells for pre- and post-flotation deinking, including pumps.
- MultiScreens with C-bar baskets and MultiFoil rotors for fine screening.
- Thune disk filter for thickening, with bagless segments.
- DX disperger with direct heating to remove printing particles from the fibers.

Important stock preparation components for this plant, such as the flotation deinking cells, were manufactured and supplied by Voith Liaoyang in China.

Voith's proven and tested quality will contribute to the customer's long-term benefit.

Voith also supplied control field instrumentation for all machinery delivered.

EcoCell flotation system.

Immediately after the order was placed, Voith process engineers and C&I specialists started compiling all necessary design drawings and documentation for setting up the deinking system, consisting of:

- Basic layout drawings.
- Stock and water balances including piping and instrumentation diagrams.
- Motor and equipment listings.
- Vat and piping layouts.
- Instrumentation specifications and dimensioning.
- Operations planning including software testing by DCS suppliers.
- Basic planning data for C&I installation.

During the ensuing technical discussions held both in Guangzhou and Ravensburg, all further details were worked out between the partners' project teams.

After punctual delivery of the machinery, the erection work started in November 2005. Thanks to Guangzhou Paper's professional coordination, and the excellent on-site teamwork by all parties concerned, the entire erection was easily accomplished on time. Any required small adjustments were completed rapidly and unbureaucratically.

Commissioning started immediately after completing erection work and installing the electrical and C&I systems. Here again, teamwork between the mill personnel and Voith commissioning engineers was outstanding. With the system ready for start-up in March 2006, finished stock was supplied to the various paper machines just a few days later, as planned. Afterward, the only tasks remaining were optimization tweaks to further improve results.

Now that the actual project phase is over, contact between Guangzhou Paper and the Voith team is as cordial as ever. This was very evident during the meetings and negotiations held in September and October 2006 that led to Guangzhou Paper placing an order with Voith Paper for another deinking system.

It goes without saying that only a completely satisfied customer would place such a large follow-up order with the same supplier.

This new deinking system, with a planned capacity of 1,360 t/24 h, will be one of the largest in the world. It will be erected on the new mill site outside Guangzhou city and is due to go into operation by the end of 2007 (see article on the right).

Thickening system with Thune disk filters.

... and now Guangzhou Paper has ordered another large deinking system

By signing the order in October 2006 for another stock preparation system, which also will be used for improved newsprint, Guangzhou Paper has again decided in favor of Voith. With a capacity of 1,360 t/24 h finished stock, this will be one of the world's largest deinking systems.

This latest investment signals the transfer of Guangzhou Paper's entire mill capacities, including a complete new paper machine, to the new industrial zone outside Guangzhou.

Voith's scope of delivery for the new deinking system includes the prescreens and cleaner systems, 2-stage flotation deinking cells, fine screening with C-bar baskets, disk filters, screw presses and dispergers, as well as the entire additive preparation system and control field instrumentation.

As with the preceding order, Voith will again be supplying basic engineering for the entire line, C&I system engineering (including operations planning), as well as erection and commissioning supervision. Voith will again supply control field instrumentation for all the machinery delivered.

This follow-up order is solid proof of Guangzhou Paper's confidence in Voith Paper deinking technology. It confirms the excellent relations established between Guangzhou Paper and the Voith Team during the first project.

The cordial atmosphere of the contract signing ceremony on October 10, 2006 with the Guangzhou Paper management. Among those present were the Chairman of Yue Xiu Holding, and high-ranking officials representing the municipality of Guangzhou.

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Mixing efficiency of the new IntensaPulper compared with a conventional pulper. These test results under identical conditions (stock consistency and power consumption) show mixing progress 5, 10 and 15 seconds after color injection.

The IntensaPulper – a revolutionary energy-saving pulping concept

It has always been a matter of course for Voith to take Total Cost of Ownership into account in new machinery design and developments. In times of sharply rising energy costs, energy-saving machinery is even more important, and applies particularly to stock preparation machinery.

This article examines the various operating modes of pulpers defibering primary fibers. A new development is introduced that uses only as much energy as actually required for pulping. For example, significant energy savings can be attained with this pulper concept, which features a design that has remained almost unchanged for decades.

Influence of operating mode on energy consumption

Primary furnish can be pulped either in individual batches or in continuous operating mode. Most pulpers for defibering primary fibers today are operated in batch mode.

The new IntensaPulper with eccentrically arranged rotor and double cone bottom for optimal mixing and flow configuration.

The batch-pulping mode is usually preferred for throughputs below 200 t/24h, or for complex mixtures of different kinds of primary fibers associated with frequent changes of product and/or color.

Batch pulping involves unproductive work cycles, such as filling and emptying of the pulper vat. A considerable amount of energy and time is consumed that would otherwise be available for the actual pulping process. The production capacity of batch pulpers is therefore lower than that of continuous pulpers. Another drawback of batch pulpers is stock consistency fluctuations, due to dilution during the intermediate emptying and flushing phases.

Continuous pulping is clearly more energy-efficient. This operating mode is suitable for throughputs exceeding 200 t/24h, and it uses a relatively straightforward furnish mix. Continuous pulping consumes about 40% less energy compared with the batch-operating mode. Moreover, with a suitable control strategy, the stock consistency remains constant and simplifies the overall stock preparation process.

Agitation and mixing

Optimal agitation is indispensable during every pulping phase, and only as much energy should be applied to the suspension as is actually required for the defibering process. This means, that in a batch-pulping mode, the surface motion of the suspension can almost cease when the stock consistency is high at the end of each pulping phase. On the other hand, there must be enough agitation in a continuous pulper to draw the bales into the rotor vortex – on no account can they be allowed to settle at the bottom of the pulper. The optimal agitation energy can be defined by the coefficient of power to volume [kW/m^3], which varies according to application and operating mode.

Another important criterion for optimal pulping is the flow pattern on the surface of the suspension. This is much more difficult to evaluate, because it cannot be defined in terms

of a simple coefficient. Good mixing of the suspension requires frequent rotor contact with the furnish bales, and in practice this is assessed visually. If, for example, a bale remains on a concentric circulation path for too long in the pulper, it does not contact the rotor frequently enough. As a result, mixing is inadequate and so is pulping. To ensure intensive mixing, most pulpers today have baffles on the vat wall to break up the flow pattern by diverting the mainly rotational flow inward toward the rotor. The drawback is that flow interference entails loss of energy. This applies not only to the baffles, but also to the pulper bottom design. Voith has been carrying out development work on both these components in order to make optimal use of flow energy for pulping.

Energy-optimized agitation through asymmetrical motion and optimal pulper bottom design

As a result of these developments, the new IntensaPulper incorporates two important features:

- The rotor is positioned eccentrically in the cylindrical vat.
- The transition from the pulper bottom to the vat walls is flow-optimized with a double-cone design.

An eccentric rotor arrangement in the pulper vat results in good mixing, thanks to asymmetrical flow. The IntensaPulper rotor is therefore installed off-center. Since this alone optimizes mixing, no energy-wasting baffles are required and more energy is available for pulping.

An optimized transition from the horizontal pulper bottom to the vertical vat walls enables further exploitation of flow energy for pulping. In the new IntensaPulper, the transition from the pulper bottom to the vat walls is optimized with a specially designed double-cone bottom. The two cone angles are precisely determined to simulate a low-loss, torospherical profile optimally diverting the flow generated by the pulper rotor.

Potential savings with the IntensaPulper

Performance tests on a 20 m^3 IntensaPulper, operating in batch mode, showed a 26% reduction of specific energy consumption [in kWh/t] compared with the conventional pulper previously used. Furthermore, production output was 7% higher, with the same defibering quality.

In absolute figures, this means that an IntensaPulper with an output of 100 t/24 h saves about 175,000 kWh per year. This energy savings reduces operating costs significantly.

In continuous operating mode, specific energy savings with the newly developed IntensaPulper are similar. Particularly for large throughput capacities, the resultant cost savings can be substantial.

Summary

- A pulper defibering primary fiber in continuous operating mode principally consumes about 40% less energy than in batch mode because unproductive energy-consuming phases are avoided.
- The IntensaPulper has an eccentrically arranged rotor for optimal mixing – without energy-wasting baffles on the pulper walls.
- The IntensaPulper bottom is flow-optimized with a double-cone design.
- Results: the eccentric rotor arrangement of the IntensaPulper saves about 25% specific energy in batch pulping mode and increases production throughput while achieving the same defibering quality.

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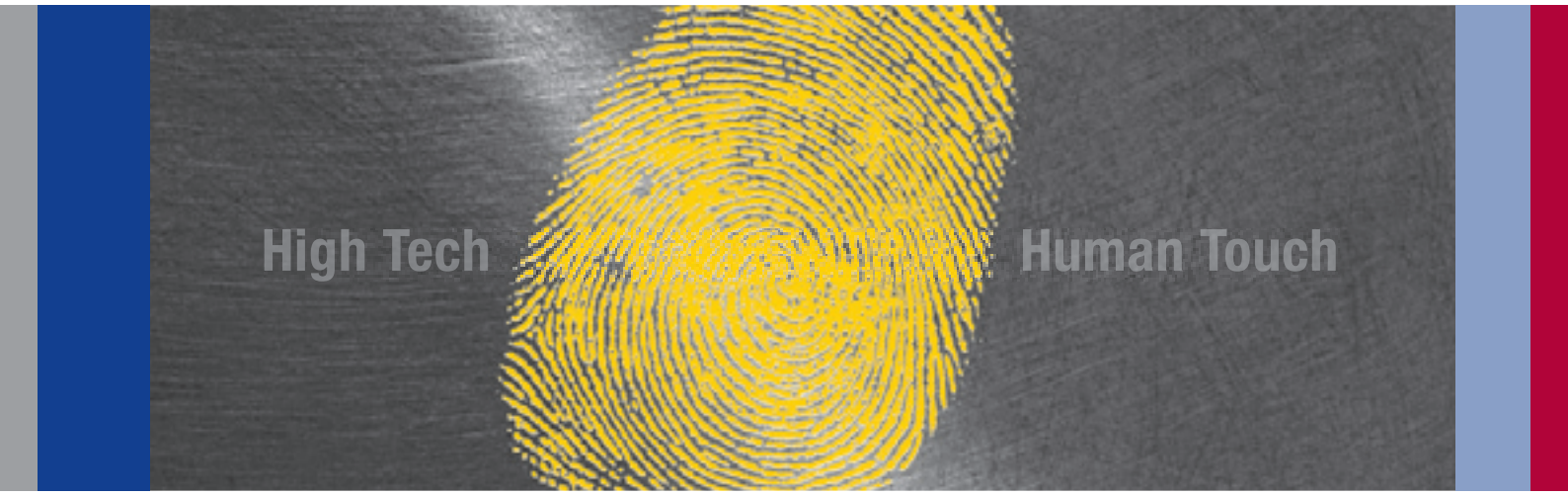


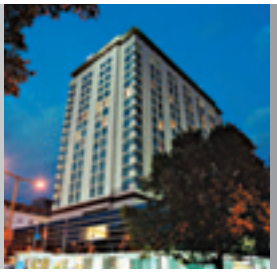
ahead07 International Voith customer conference for the board and packaging paper industry

"High Tech – Human Touch" is the slogan for Voith Paper's ahead07 customer conference to be held this year from May 9 to 11 in Vienna, Austria. Customers from all over the world are cordially invited.

In the fittingly modern Hilton Vienna Conference Center, Voith Paper will be focusing this time on the human aspects of the paper industry. Services and solutions, processes aside from high technology, and knowing the customers' wishes are the focal point of the conference. And as always, the latest Voith innovations will be reviewed as well.

An attractive, service oriented fringe program will also provide a relaxed atmosphere with the opportunity for intensive experience exchange and interesting technical discussions.

For more details, please visit:
www.ahead07.com



Shandong Huatai Paper – Voith paper machines now meet half of China's newsprint needs

Shandong Huatai Paper Company Ltd., China's leading newsprint producer, once again chose a Voith newsprint line: PM 12 was commissioned at the end of October 2006. This article describes its twin machine PM 11, which went on line at the end of 2005.

Voith's partnership with Huatai Paper started 11 years ago with the delivery of high-tech components for PM 1. This fruitful relationship grew with the delivery of the former Schongau PM 9 in 2000. In July 2003, PM 10 was commissioned, a complete Voith production line for high-grade newsprint.

The outstanding high quality newsprint produced on PM 9 and PM 10 very soon established its reputation on the market. The enormous demand for this paper opened the way for further investments (China's newsprint needs have almost quadrupled over the last decade). Voith, as preferred supplier, received the order for PM 11 in June 2004, and one year later for its sister machine, PM 12, in June 2005.

Since PM 12 started up in October 2006, Voith paper machines produce no less than 1,200,000 t.p.a. of newsprint in Huatai for the Chinese market – nearly half the national output.

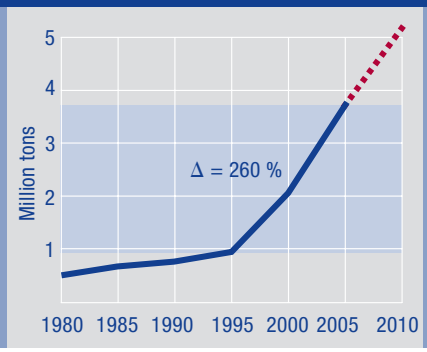
Shandong Huatai Paper – steep growth

Everything started in 1976 when Li Jian Hua, now President of Huatai Group, was appointed production manager of a small paper mill in Huatai. That was the beginning of an outstanding success story both for President Li and for his Huatai Group.

Shandong Huatai Paper Company Ltd., listed on the Shanghai Stock Exchange since the year 2000, recorded 750 million Euro sales in 2005. This company belongs to the Huatai Group, active not only in paper production but also in the chemical and printing industries, forestry, logistics and trading. About 4,400 of the Huatai Group's 10,000 employees work for Huatai Paper, whose mills are located exclusively in Shandong province and currently have a production capacity of 1,200,000 t.p.a. The Huatai management center is located in Dongying, near Dawang.

Huatai Group owns 32.33% shares of Shandong Huatai Paper Co. Ltd. Forty percent of Huatai Group's assessed value is currently held by President Li Jian Hua. 27.34% by the municipality of Dawang, 20% by 18 members of the company's executive management and 12.66% by Dawang Group.

Shandong Huatai Paper PM 11.



Newsprint demand in China.

Huatai in Dongying, Province Shandong.

EcoMizer cleaners.

Huatai PM 11 – a complete production line without peer

Huatai PM 11, one of the most modern newsprint lines in the world and largest in China, was very successfully commissioned at the end of the year 2005 – less than 19 months after contract signing and four months earlier than planned – with the first production series of breaks-free jumbo rolls. All Voith Paper divisions – Fiber Systems, Paper Machines, Finishing, Automation, Rolls and Fabrics – took part in this project.

The close partnership between Shandong Huatai Paper Co. Ltd. and Voith, which deepened still further after the successful PM 10 project, made this greenfield mill project a success. So far, PM 11 has developed very well, as confirmed by market reception of the excellent newsprint quality.

This turnkey production line was installed in record time in a building erected directly behind PM 10. Its twin machine, PM 12, has now been installed parallel to PM 11.

The impressively large Huatai mill site includes a power station, pulp production line, canal system to the Yellow River, offices and accommodations, as well as a planned rail connection for transporting paper rolls. Huatai deserves great credit for achieving the rapid growth that has enabled completion of four large paper machine projects in only five years – future-oriented facilities employing the latest technology for first-class paper production in China.

Founded in 2002 with an eye to the future, the nearby Voith Paper Rolls service center is already supporting the Huatai mill. This subsidiary has proved a valuable partner for project execution in such areas as logistics, customs formalities, roll servicing, and small repairs.

In June 2004 Voith was entrusted with delivery of the complete newsprint production line that uses recovered paper furnish. Based on the "One Platform Concept," PM 11 produces high-grade newsprint in a basis weight range of 42 to 49 g/m^2 for color offset printing, with an production capacity of 400,000 t.p.a.

This machine has a wire width of 10,200 mm and a design speed of 2,000 m/min. The scope of supply also included the complete deinking line from the drum pulper to the

Customer Comment

Li Jian Hua
President and spokesman, Shandong Huatai Group management

"Voith Paper provides its customers with the latest technology and first-class service. During the course of time, our close teamwork has blossomed into a genuine friendship between Voith and Huatai. The extremely successful start-up of our Voith PM 11 newsprint machine, with a capacity of 400,000 t.p.a., has not only made Huatai Paper China's leading newsprint producer, but also consolidated our excellent reputation."

EcoCell preflotation and afterflotation in double-decker mode, with Thune disk filter. In the foreground is the first stage of the MultiScreen slotted fine-screen system.

Thune screw presses.

finished stock storage tower, including complete engineering, chemical preparation, and automation. Voith Paper Fabrics delivered felts and wires for the forming section, press and dryer section.

Comprehensive control measures based on the Voith quality management system certified to DIN ISO 9001, and compliance with the Huatai internal regulations, ensured trouble-free manufacturing and delivery of all components. For subcontractors and in-house production, all quality control inspections were based on previously defined criteria and certification plans.

To ensure optimal and efficient project execution, several liaison and coordination meetings were held on a jointly established basis. The professional organization and excellent teamwork between Huatai and Voith from start to finish were critical to the success of this project.

Due to the extremely tight paper machine manufacturing and pre-assembly schedule, including all components and civil works, this was another very challenging project for Huatai Paper and Voith. Comprehensive logistics coordination for all suppliers had to be mastered in a very short time. But thanks to the efficiency of Chinese site erection contractors under Voith supervision, the entire erection work was completed in only five months.

All planning documentation to ensure correct erection of the deinking line machinery, piping, electrical installations, control systems and chemicals processing was prepared in close teamwork between the Huatai and Voith engineers. This work was considerably facilitated by the previously intensive cooperation during the PM 10 planning phase, which enabled fast decision-making and detailed optimization based on existing experience.

TopDuoRun, EcoSoft and Sirius.

Key components of the Voith PM 11

- ModuleJet headbox
- DuoFormer TQv with BlackStone S rubber roll covers
- Tandem NipcoFlex press with G2000 polyurethane roll cover
- TopDuoRun dryer section with CeraGuide thermal roll coatings, 8 dryer groups (36 drying cylinders)
- EcoSoft Delta calender with Vantis S calender roll covers
- Sirius reel (parent roll diameter 3,700 mm)
- Tail transfer
- Dryer hood
- Hydraulic and pneumatic systems
- Central oil lubrication system
- Spare parts
- Erection supervision
- Commissioning and operator training

The key components of the tail transfer system after the dryer section comprise a dual high-pressure water jet slitter, a TT3000 “Bullhorn” transfer device, and 11 VTT turbo-transfer belts.

Key components of the Voith DIP stock preparation line for PM 11

- Combi MultiSorter screen (1.2 mm hole diameter) in the first stage, and Combisorter with cleaner in the second stage
- MC slotted MultiScreen and MiniSorter
- 4-stage heavies cleaner with HydroCyclean and EcoMizer technology
- EcoCell flotation I with 7 primary and 3 secondary cells
- 4-stage fine slotted screening with various MultiScreens and MiniSorters
- Thickening I with Thune bagless disk filter and Thune screw press
- Disperging with equalizing screw and DX disperger, followed by oxidative HC peroxide bleaching
- EcoCell flotation II with 5 primary and 2 secondary cells
- Thickening II with Thune bagless disk filter and Thune screw press, followed by reductive hydro-sulphite bleaching and finished stock storage vat
- Complete additives plant for the DIP line
- For internal water purification 3 Deltapurge microflotation groups were installed by the Voith joint venture partner Meri
- Components for the PM rejects system, plus special control equipment and valves
- Commissioning and operator training

The scope of services agreed upon with the customer includes not only the entire process and control engineering, but also erection contractor support by the Voith erection supervisors.

High efficiency and product quality, thanks to comprehensive automation

The automation systems are aligned not only to the specific product grade demands on PM 11, but also to individual process requirements ranging from raw material processing to end product handling. They provide a uniform operating and engineering platform for on-machine control.

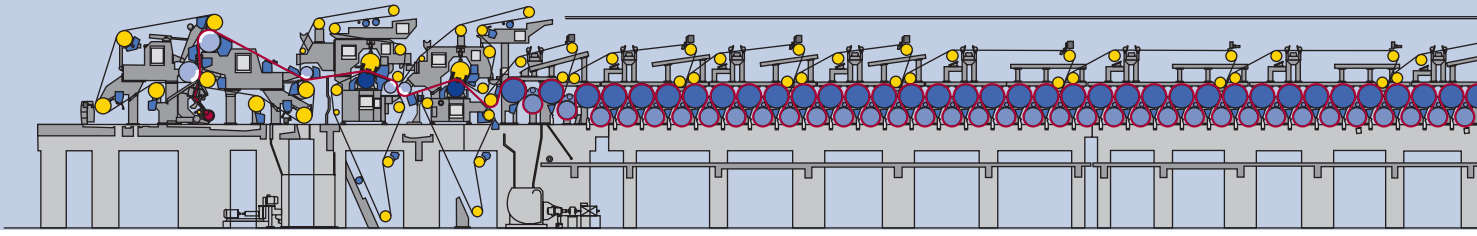
Key components of the automation systems:

OnControl
- On-machine control

OnQuality
- OnQ ModuleJet, dilution water control with Profilmatic cross-profile control software
- OnQ ModuleSteam, steambox with Profilmatic system
- OnQ ModulePro, dual medium nozzle moisturizer with Profilmatic system
- OnQ ModuleNip, caliper and gloss control with Profilmatic system
- All MD profile controls

OnView
- OnView information system with trending and reporting functions
- RollMaster for optimizing paper roll winding quality on reel

The extensive factory acceptance test (FAT) prior to delivery enabled fast and trouble-free commissioning of PM 11 according to the well-proven “Plug & Work” principle.



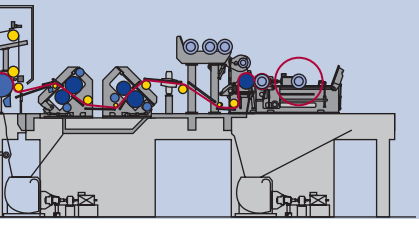
Key components delivered by Voith Paper Fabrics

• PrintForm H series
Two sets of the Voith Paper Fabrics PrintForm H series were ordered for the forming section of Huatai PM 11. The first set, currently in service on the machine, is performing well in terms of runnability and sheet quality.
The PrintForm H series fabrics were designed to control the initial dewatering around the forming roll, pushing more water into the forming shoe and blades for improved sheet formation.
PrintForm H forming fabrics have resulted in high dryness at the press section intake, and less wire marking compared with our competitors' products.

• Dryer Fabrics
Due to our outstanding success with Huatai's PM 9 and PM 10, Voith Paper Fabrics is the preferred supplier of dryer fabrics for PM 11. The first fabric is currently in service on the first group, and is performing well, with good sheet control and no marking.

Technical data of PM 11

Design speed	2,000 m/min
Wire width	10,200 mm
Max. untrimmed web width	9,580 mm
Parent roll diameter	3,700 mm
Production capacity (at 1,800 m/min operating speed)	1,210 t/24 h
Raw material	AONP, AOMG, CONP, CMOW



The entire stock preparation line planning was based on process technology data derived from the Voith process flow chart and mass flow balance.

All measuring and control equipment was specified, and precise documentation was compiled for programming the stock preparation line process control system. Its implementation was scrutinized down to the last detail by Voith specialists during the course of functionality tests (FAT).

The successful erection and commissioning was based on meticulous planning of all activities in teamwork with Huatai Paper and joint agreement on goals. Thanks to the transparent supervision of project progress, all work was completed systematically and according to plan.

Based on the well-proven Voith project management, site- and commissioning-management system, the erection personnel completed the function tests in teamwork with the commissioning team. Here again, as with all other Voith commissionings, efficient execution was based on transparent and trustworthy teamwork with the customer's engineers.

"Quality tons on reel and ramping up production as quickly as possible, making a good quality paper" – this common goal was reached in less than 19 months after contract signing – another record in the Huatai success story!

Clearly, the Voith Paper "One Platform Concept" verifiably ensures not only the fastest possible commissioning and steeper start-up curves, but also full compliance with paper quality guarantees for a rapid return on investment.

PM 11 produced paper for the first time on December 31, 2005. After a series of eight breaks-free jumbo rolls of saleable newsprint had been produced, successful start-up was officially certified one week later on January 5, 2006. By the end of January 2006, a continuous output of more than 950 t/day of first-class newsprint had been attained at a production speed exceeding 1,650 m/min. The technical dependability and overall line efficiency, attained so early, already approach the level expected after full optimization.

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Exemplary teamwork – Shandong Huatai Paper breaks another world record

On October 31, 2006 Huatai Paper Company Limited's new PM 12 line in Shandong province started up successfully – in the record-breaking time of only five months after commencing erection work on June 1. And on November 18 the customer already certified commercial operation.

The Voith PM 12 line in Shandong produces high quality newsprint for 4-color offset printing. This new machine is the identical twin of PM 11, described in the previous article. With a design speed of 2,000 m/min, a wire width of 10.2 m and a production capacity of 1,210 t/24 h at 49 g/m^2, PM 12 joins PM 11 as one of the world's largest, fastest and most modern newsprint machines. Like PM 11, it was built according to the Voith "One Platform Concept".

Voith, as single-source supplier, delivered the entire PM 12 production

line – from stock preparation to paper roll wrapping and transport – thereby eliminating delivery interfaces with other suppliers. This was the main reason for the incredibly short erection and commissioning time of only five months: an impressive improvement over the previous times for PM 10 (eight months) and PM 11 (seven months). The average erection and commissioning time for comparable non-Voith lines today is about eight months.

The Voith scope of supply for PM 12 covered recovered paper stock preparation, the approach flow section according to the Advanced Wet End Process concept, the paper machine itself, two VariFlex two-drum winders with ElaGrip drum technology, and a fully automated robot-supported paper roll wrapping machine including automated roll transport system. Voith also supplied the comprehensive automation system for PM 12, comprising on-machine controls, quality control system and data system. The entire Voith process know-how was fully implemented in engineering for the C&I, recovered paper and additives handing systems, and for the machine control systems.

PM 12 is the fourth successive Voith line to start up in Huatai. It will enable Huatai Paper to uphold its position as China's number one newsprint producer both in terms of quality and production volume. Shandong Huatai Paper's annual output of high quality newsprint – no less than 1.2 million t.p.a. per end of 2006, about half China's total production volume – is produced entirely on Voith machinery. Huatai Paper's ongoing confidence in Voith reflects the close and long-standing partnership between the two companies: a success story to be continued with the next PM 13 already under discussion.

The next edition of twogether magazine will include a further update on developments at Shandong Huatai Paper, including a detailed report by the customer.

“Perfect Fit” – Burgo Sora PM 1 rebuild

Burgo-Marchi placed the Sora PM 1 rebuild order with Voith Paper Italy in mid January 2005. Only eight months later, involving only 30 days of shutdown, the rebuilt machine started commercial operation again in September 2005. And during the entire period since this rebuild, PM 1 at the Burgo-Marchi Sora mill has met all expectations to the customers’ complete satisfaction. As an added reference, this rebuild also incorporates Voith’s first transfer belt application in Italy.

The Burgo-Marchi Group was created in mid 2004 by the merger of Cartiere Burgo S.p.A. and Cartiere Marchi S.p.A. With 27 production lines in 14 paper mills in Italy and 1 in Belgium, the group is at present the main producer of graphic paper in southern Europe. The Burgo-Marchi group produces 3,230,000 t/year of coated paper, base paper and newsprint. 85 percent of total output comprises the Group’s specialties of CWF (Coated Woodfree) and CMR (Coated Mechanical Reels) grades for magazines, catalogues, inserts and other commercial print products. In these

two segments the Burgo-Marchi Group commands a European market share of almost 14%.

Located in central Italy, the Burgo Sora mill has two paper machines for producing coated woodfree paper: PM 1 in a basis weight range of 55-93 g/m^2 and PM 2 in a basis weight range of 100-150 g/m^2. The paper width at reel is 3,770 mm on both machines.

Voith's scope of supply for the PM 1 rebuild included the following new components:

- 3-stage slotted screening system and 4-stage cleaners
- MasterJet II F headbox with ModuleJet dilution system and screening technology to suit
- DuoSuction NipcoFlex press section with transfer belt
- DuoStabilizer boxes in the first dryer group.

Sora PM 1 has a wire width of 4,270 mm, and the design speed after rebuild is 1,300 m/min. Currently the machine is only operating at 950 m/min, but the design speed and planned production capacity of 140,000 t.p.a. should be reached after completing the second rebuild phase – on the dryer section and on-line coater – at the end of 2007.

DuoSuction NipcoFlex press

The main portion of the supply was the new press section, with the following rebuild goals:

- PM efficiency enhancement by eliminating free draws and reducing moisture content at the dryer section intake
- Improvement of paper properties thanks to a new concept hardly ever used so far for paper machines with wire width less than 5,000 mm.

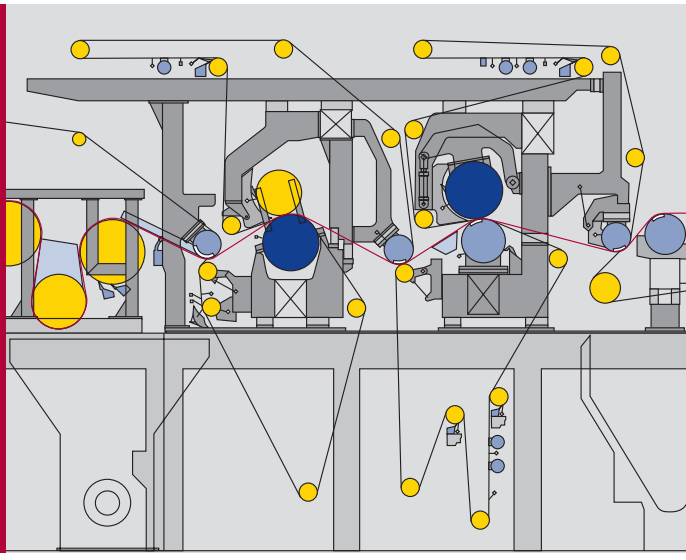
The new press section is distinguished by two nips and the absence of free draw. The first nip comprises a suction press roll in bottom position with Aqualis polyurethane cover, and a top press roll with grooved stainless steel cover. The second nip comprises a NipcoFlex shoe press, with NipcoFlex roll in top position and a bottom press roll with grooved stainless steel cover. Thanks to Voith's first transfer belt application in Italy, the web is transferred to the dryer section via the suction roll without any free draws.

Three interchangeable suction rolls transfer the web in full width from the forming wire to the first dryer group, without using a tail. After the first dryer cylinder, the whole web width runs into the press rejects pulper. Subsequently, the tail is formed by the tail cutter positioned under the transfer foil at the dryer section inlet.

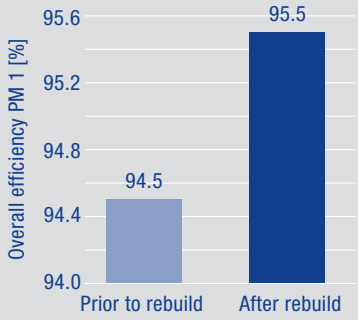
Not only does the transfer belt eliminate free draw between the press section and dryer section, but it also has the advantage of significantly reducing sheet rewetting.

All in all, the rebuild team can justifiably be proud of the results.

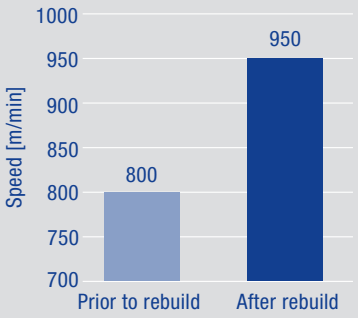
DuoSuction NipcoFlex press.



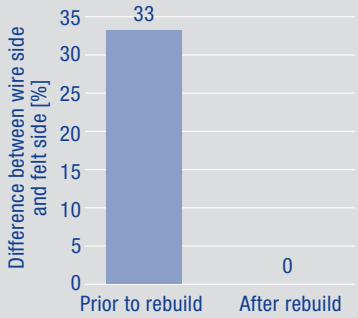
"Perfect Fit" rebuild results – not bad at all!



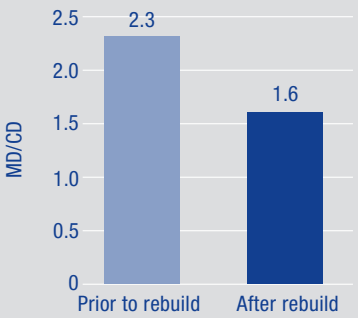
Overall efficiency.



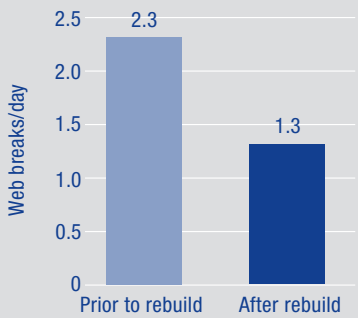
Paper machine speed.



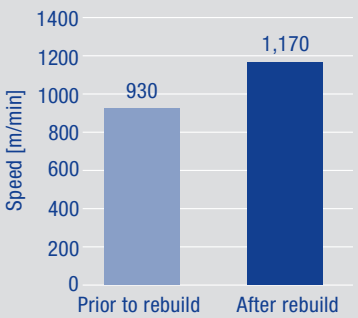
Two-sideness of smoothness.



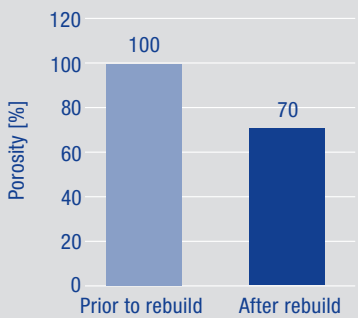
TSO



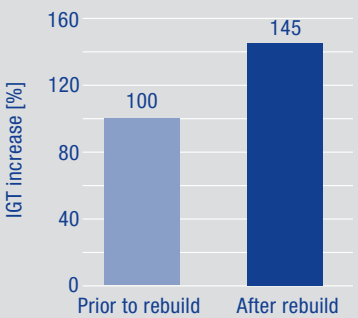
Web breaks per 24 h.



Off-line coater speed.



Porosity improvement.



Printability.

Results

The machine was optimized rapidly, and the advantages of the new press section were obvious right from the beginning of the commissioning phase.

The paper machine efficiency was improved over all speed ranges.

Thanks to the new press section concept, the base paper smoothness now exhibits no two-sidedness. The subsequent optimization phases enabled a reduction of sheet porosity and improvement of fiber orientation. Bulk is now higher than prior to the rebuild, and moisture content at the dryer section intake is no more than 48%.

As confirmed by printing results, the finished sheet surface is more uniform thanks to an optimally blended coating.

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Aracruz Celulose banks again on Voith Technology

At the end of 2005 Voith's 300th NipcoFlex shoe press was successfully commissioned at Aracruz Celulose in Guaiba, Brazil. As part of a pulp drying machine upgrade, it considerably increases the mill's production output.

First introduced years ago, shoe presses are now well established in the pulp and paper industry. They are fitted to nearly all modern paper and board machines for practically all grades, as well as to pulp drying machines.

NipcoFlex shoe presses for web widths of 2,600 to 10,600 mm and speeds of 50 to 1,912 m/min are operating worldwide to the complete satisfaction of users. In order to stay one step ahead of ongoing customer needs, a special NipcoFlex test unit is

Customer Comment

Romeo Zanchin
Project Manager at Aracruz Cellulose for the Guaiba Project

All the project goals were fully attained to our complete satisfaction. The agreed delivery deadline, costs and dryed pulp quality improvement targets were met in full. Voith's valuable support of our training and qualification plan played a key role thereby in our success today. And it was thanks to Voith's outstanding teamwork as our partner in this project that the entire erection and commissioning procedures were completed so rapidly and efficiently.

All the components delivered by Voith are of first class quality, and the production data have not only confirmed all guarantees but exceeded them: with a daily output of 1,250 tons and a sheet dryness of more than 55% after the NipcoFlex shoe press. These excellent results are of fundamental importance to us in view of our capacity limitations in the drying section.

In particular, I would also like to emphasize Voith's partnerly support both in the preliminary stages of the project and during its entire execution. This included analysis of the financial aspects, practical evaluations and on-site tests, and detailed investigations of alternatives. We look forward to continuing this friendly cooperation with Voith.

already undergoing trial runs at continuous speeds of up to 3,000 m/min. NipcoFlex shoe presses offer big advantages both with regard to production output and product quality. Voith is the market leader in this segment with a share of more than 60 percent. The Voith NipcoFlex shoe press is the most reliable and well-tried technology on the market.

The 300th NipcoFlex shoe press that went on line at Aracruz Celulose per end of 2005 is installed as part of a pulp drying system. This is already the second NipcoFlex shoe press installed by Aracruz Cellulose – a sure sign of the customer's trust in Voith pulp drying technology. It is fitted with QualiFlex roll covers, and plays an important role in increasing production output of eucalyptus pulp from 400,000 to 455,000 t.p.y.

Apart from the 15 percent production increase, this NipcoFlex shoe press has also enabled Aracruz Celulose to reduce specific steam consumption thanks to lower pressure in the drying section. Moreover, basis weight has increased due to the higher dewatering capacity, and the improved runnability has reduced the number of shut-downs.

In order to further improve the pulp web quality, basis weight cross-profile control with an Aquacontrol dilution water system was installed. The water-loop, pulp and vacuum systems were also optimized and modernized with new piping, pumps and motors. In this connection the DC system was replaced by AC motors with frequency converters, and new gear drives were installed. The scope of supply also included

Wire section (left) and 300th NipcoFlex Shoepress (below).

Aracruz Cellulose eucalyptus plantation.

operator training as well as erection and commissioning supervision. For commissioning, Voith Fabrics supplied first fabrics in the third dryer group.

Particularly notable are the social arrangements made by Aracruz in the Guaiba region. Together with numerous companies including Aracruz und Senai, Voith supports thereby a “personnel qualification plan” training and advancement project for pulp and paper industry employees in the locality. This has enabled more than 500 employees in widely varied trades to undergo intensive training in a facility for which Voith donated the equipment and financed renovation of the premises. Some of the trainees have already been able to prove their newly acquired capabilities in connection with the Aracruz project realization.

The success of this project and the customer’s satisfaction are impressively reflected in the commentary below by Romeo Zanchin, Project Manager at Aracruz Cellulose for the Guaiba Project.

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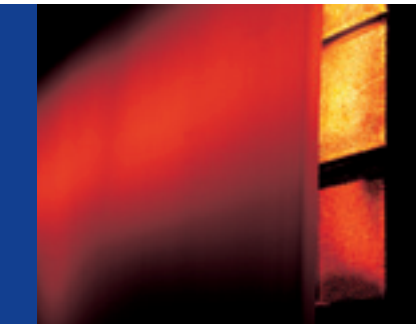
Paper mill Mitsubishi HiTec Paper Bielefeld, Germany.

Mitsubishi HiTec Paper – Energy management: a masterable challenge



The importance of saving energy has long been recognized, but only recently has it been taken so seriously in industrial circles, including the paper industry. Since the steep rise in energy tariffs recently, particularly last year, greater priority is being given again to energy-saving measures. Such measures are typically taken in areas not necessarily belonging to everyday papermaking activities, so expert support in these specialized areas can be very helpful.

Such considerations and common discussions on the subject led to Mitsubishi HiTec Paper Bielefeld placing an order with Voith Paper Heidenheim for an energy savings study. In order to attain the biggest possible savings in the shortest possible time, this study focused on the PM 3 steam and condensate system in Hillegossen – a notoriously energy-intensive area offering high optimization potential accordingly.

System concept

On two paper machines and several coaters, this mill produces special grades such as carbonless paper, thermal paper, high quality inkjet papers and cast-coated labels. In 2005 the Stadtwerke Bielefeld GmbH built a combined cycle power plant on this site to supply the mill with electricity and steam.

Based on this situation, joint discussions were held to define the focal points for study and evaluation. It was found that with so many interfaces between the PM 3 steam/condensate system and other process zones, the study would have to be further extended in some cases in order to make a realistic assessment.

First of all the individual study points had to be defined. Apart from aspects like exhaust and condensate heat utilization and tank insulation, the PM 3 heating system also had to be investigated. The object here was to study and optimize the individual heater operating modes.

Investigations carried out and solutions proposed

1. The Sulzer blower exhaust, currently unutilized, is ideally suitable for process water heating. Then the spray water would no longer have to be steam heated.

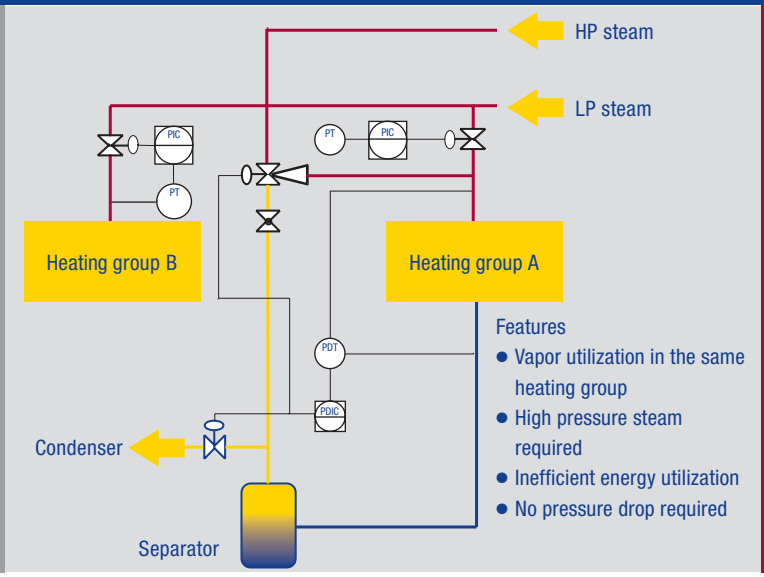
2. Currently the condensate from PM 1 and PM 3 is cooled down from about 90 °C to 65 °C for processing purposes before utilization in the power plant. Instead of wasting this thermal energy in the existing cooling tower, it can be utilized in two different ways:

- either for heating the building in which coating machine 3 is installed
- or for heating the PM 3 whitewater.

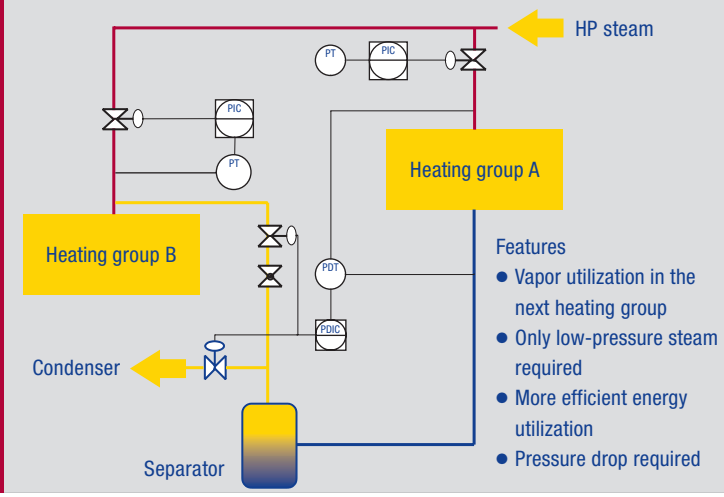
The more cost-effective of these two alternatives is worked out below.

3. The analysis results showed considerable heat losses from the clarified filtrate tanks – located outside without thermal insulation. Here again, the investment required forms

PM 3 wire section.



PM 3 heating system – Elimination of the 12-bar line, current condition.



PM 3 heating system – Elimination of the 12-bar line, cascade system.

a basis for estimating the cost-effectiveness of corrective measures.

4. An important part of this study focused on the energy balance of the existing PM 3 heating system. It was soon apparent that the operating mode of the individual heating modules needed to be optimized. The entire system and the thermo-compressor operating modes were comprehensively documented, paying particular attention to aspects such as governor settings and definition of the operating points in the compressor characteristics curves. It was also found that savings could be achieved by rebuild measures on the existing siphon system.

5. As mentioned above, a special aspect at Hillegossen was that in 2005 a new power plant went into operation. This raises the question as to whether the existing 12-bar steam line is still required at all. Currently, energy-intensive high-pressure steam is tapped from the turbine to drive the thermo-compressors and for the steam registers of the hood supply air. This reduces the power generated by the steam turbine. As an alternative to the thermo-compressor system it would be possible to install a cascade system as shown in the graphic “PM 3 heating system”.

Optimization measures can also be taken on the hood supply air system. This is still connected to the 12-bar high-pressure steam line, but it could be connected instead to the 3.5 bar low-pressure steam network.

These two measures – using a cascade system instead of thermo-compressors, and optimizing the hood supply air system – would save considerable mill operating costs by using all the energy-intensive 12-bar steam for power generation (and feeding surplus power to the grid!).

Results

Cost/benefit assessments were carried out for each measure as mentioned, based on budget price figures for any investments required. The detailed results were as follows:

Utilization of blower exhaust for spray water heating

Required investment: about 300,000 Euro. Payback time: 1.7 years.

Condensate heat utilization

Two alternatives:

- Utilization for machine hall heating
- Utilization for whitewater heating.

The results were as follows:

- Machine hall heating – payback time 15 years.
- Whitewater heating – payback time 0.96 years.

The mill management should, therefore, find it easy to reach a decision.

Off-line coater 3.

Tank insulation

The investment required for insulating the clear filtrate tanks will pay for itself in 1.9 years.

Heating system optimization

Savings can be achieved here on the one hand without any investment, or on the other with investment costs.

Without investment costs:
Control system optimization alone can save more than 100,000 Euro p.a. with the existing product range.

With investment costs:

- Siphon rebuild. Replacing the siphons and steam heads will pay off in 1.25 years.
- Thermocompressor system rebuild to a cascade system. The payback time here is 3.8 years.
- Hood supply air steam pressure reduction from 12 bar to 3.5 bar. The payback time here is only 0.8 years.

Overall payback time for the last two measures together is 2.3 years, with the aforementioned advantage that more high-pressure steam is available for power generation.

The overall savings potential revealed by this study – under the given circumstances – is almost 1 million Euro p.a. Both from the economical and ecological viewpoints, this is very significant. Bearing in mind the fairly steep rise in energy prices forecast in the medium term, the paper industry would certainly have to pay more attention to this aspect in future.

Further prospects

This study, carried out in teamwork between Mitsubishi Paper Bielefeld and Voith Paper experts Martin Dauner and Holger Funk, reveals substantial energy-savings potential for the PM 3 steam and condensate system alone. However, the matter in hand requires very specialized knowledge not necessarily belonging to everyday papermaking activities. Expert support in the relevant areas is, therefore, indispensable. For example, it is planned to hold a training course for the Hillegossen mill operators under Voith specialist leadership so that the findings of this study can be implemented as far as possible in day-to-day production.

In the end, however, this study has only focused on a small part of the overall energy-savings potential in a paper mill. All the individual plant components and their networking play an important role in optimally efficient energy utilization.

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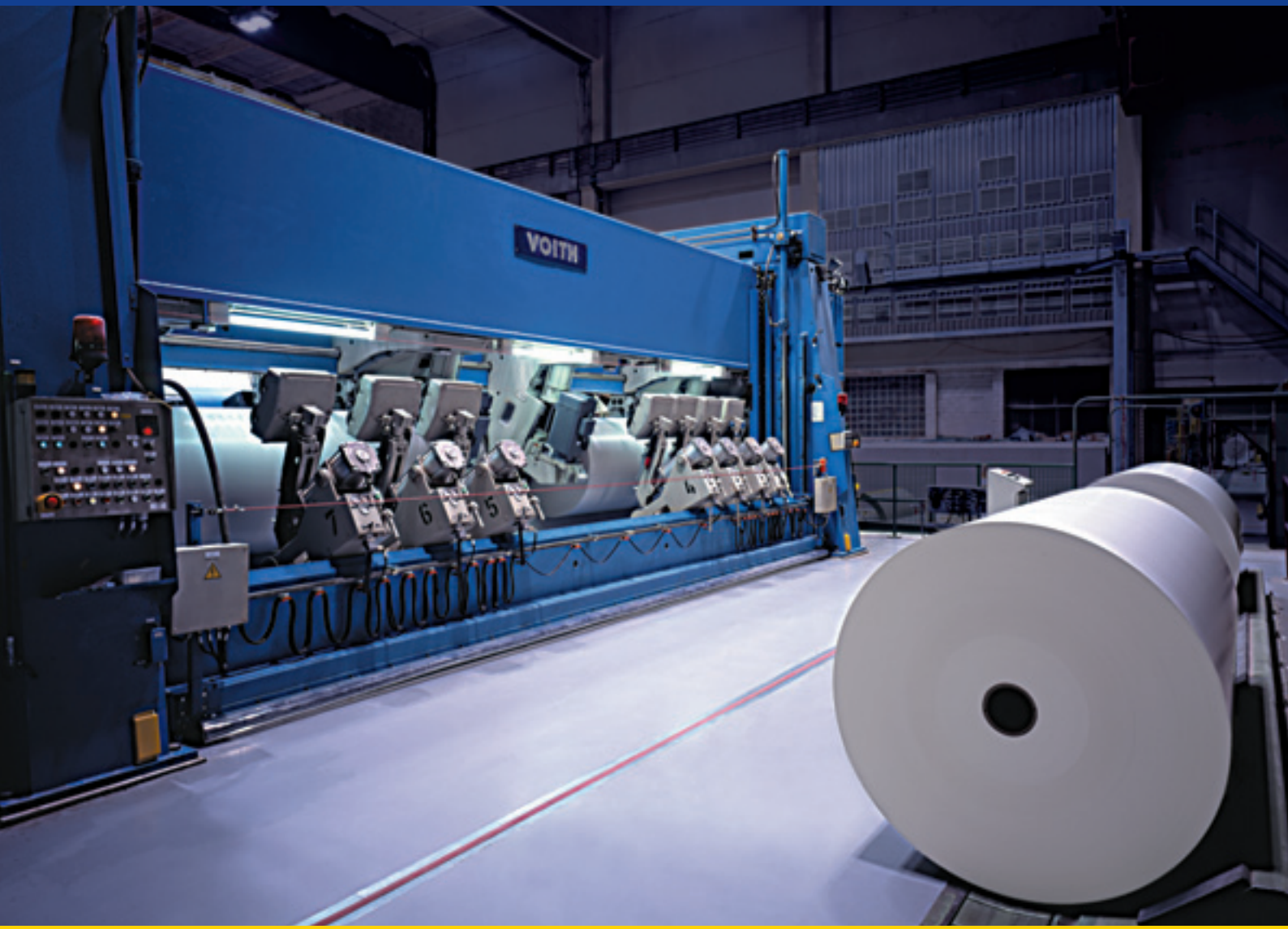


Maxau PM 6 – the rebuilt VariTop.

Maxau PM 6 VariTop winder – All high-performance promises fulfilled!

Voith's market leadership in SC paper technology has often been proved in the past. Among the five SC production lines delivered over the past ten years is PM 6 at the Stora Enso Maxau mill (see also twogether 19). After more than two years of excellent results, it is now time to report on the VariTop winder and his part to this success.

Goals

PM 6 was “modernized” – in actual fact an almost completely new paper machine was installed in the existing building – in order to boost annual production from 140,000 to 260,000 t.p.a. as a first step and enable up to 280,000 t.p.a. later on. This clearly meant upgrading the peripheral equipment as well. Two alternatives were considered:

- Installation of a new VariTop winder in addition to the existing one, or
- Upgrading of the existing VariTop to meet PM 6 needs as far as possible.

The customer’s desire to produce in future 5 m wide jumbo rolls had also to be considered.

Feasibility study

Voith experts teamed up immediately with the Maxau specialists to work out the best alternative. The feasibility study primarily focused on three aspects:

- How far could the existing maximum speed of 2,200 m/min be increased?
- How to shorten the production outage times (for set changes, etc.)?
- Which components of the 14-year-old winder would have to be replaced due to wear and in order to meet higher demands in future?

A detailed study of these questions led to unanimous agreement: the rebuild alternative would be by far the best solution!

Solution

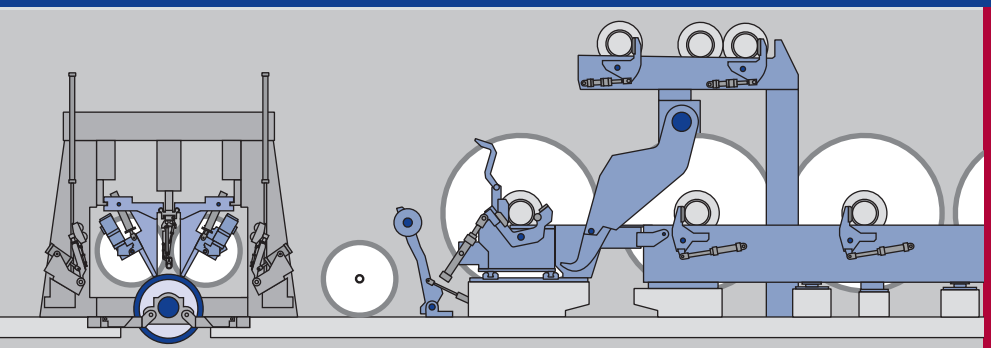
Voith, therefore, proposed to Stora Enso the following rebuild solution:

- Installation of a new parent roll unwind
- A fully automated magazine for 3 parent rolls
- A reel spool lifter system
- A magazine for empty reel spools
- Adapting the unwind splice to the new maximum diameter of the parent rolls
- Modernization of the web severing system and web tension relief roll, and of glueing at the sheet beginning and end
- Modification of the winder drum drive mechanism
- Special ElaGrip coating on the winder drum for improved winding
- Two heavy-duty stations for parent rolls up to 5 m wide
- Installation of a new cores table
- Replacement of the winder PLC controls and production parameter control system
- Siemens SPS system conversion from S5 to S7 technology
- General overhaul of the VariTop
- Dynamic balancing of all rolls for the higher operating speed of 3,000 m/min.

Carsten Wenk, Stora Enso, congratulates Dirk Cramer of Voith Paper Finishing: “Engineered reliability – all promises kept!”

Project implementation

Fully satisfied with results of the project studies by our specialists, Stora Enso entrusted Voith with upgrading the VariTop as proposed. Having determined the scope of supply and performance, it “only” remained to execute the project with due care and



VariTop after rebuild (blue = new or rebuild).

punctuality. Clearly, this was not going to be an easy job. But thanks to scrupulously detailed scheduling and continuous planning coordination between the partners, all the manufacturing and shipping, erection and commissioning went ahead without a hitch. Naturally there were some surprises during the erection procedure – with a 3-shift team of 20 men working around the clock – such as the much more complicated tubes and pipes installation than expected. However, all erection work was nevertheless completed punctually thanks to the concentrated efforts of all concerned. In order to eliminate any start-up troubles with PM 6 as far as possible, the rebuilt VariTop was first tested and commissioned with parent rolls from PM 8. And this paid off in full: right after starting up PM 6, production went ahead smoothly with the rebuilt VariTop.

Results

In response to this exemplary start-up, Stora Enso notified the author as follows: “Having so quickly attained saleable paper production at the agreed speed of 3,000 m/min with our rebuilt winder – the world’s fastest VariTop – we take this opportunity of sincerely thanking you and your team for such excellent partnership with our Project 3000”.

Current status

For more than two years now, a single upgraded VariTop winder handles all designated paper produced by PM 6. To accomplish that it has to operate continuously at extremely high speeds of 2,900 to 3,000 m/min, but paper roll quality is nevertheless first class. Carsten Wenk, Stora Enso, sums up as follows:

Customer Comment

Carsten Wenk
Stora Enso Maxau

“We had always been fully satisfied with our VariTop built in 1990, but were sure that it could achieve more. With Voith as our project partner, we were able to minimize the winder rebuild costs required for increasing production of our PM 6. Based on a joint feasibility study of the existing winder, a custom-tailored rebuild and modernization project was worked out and fully implemented. Thanks to our partner’s outstanding teamwork also in the commissioning and optimization phases, the result was an exemplary start-up. Voith engineering and our common know-how in SC jumbo roll technology have transformed our PM 6 VariTop into the world’s highest capacity SC winder. All project goals were attained in full: a superlative achievement!”

Project 3000 – the world’s highest capacity SC winder.

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Handling bigger and heavier rolls – No problem with Voith Finishing logistics

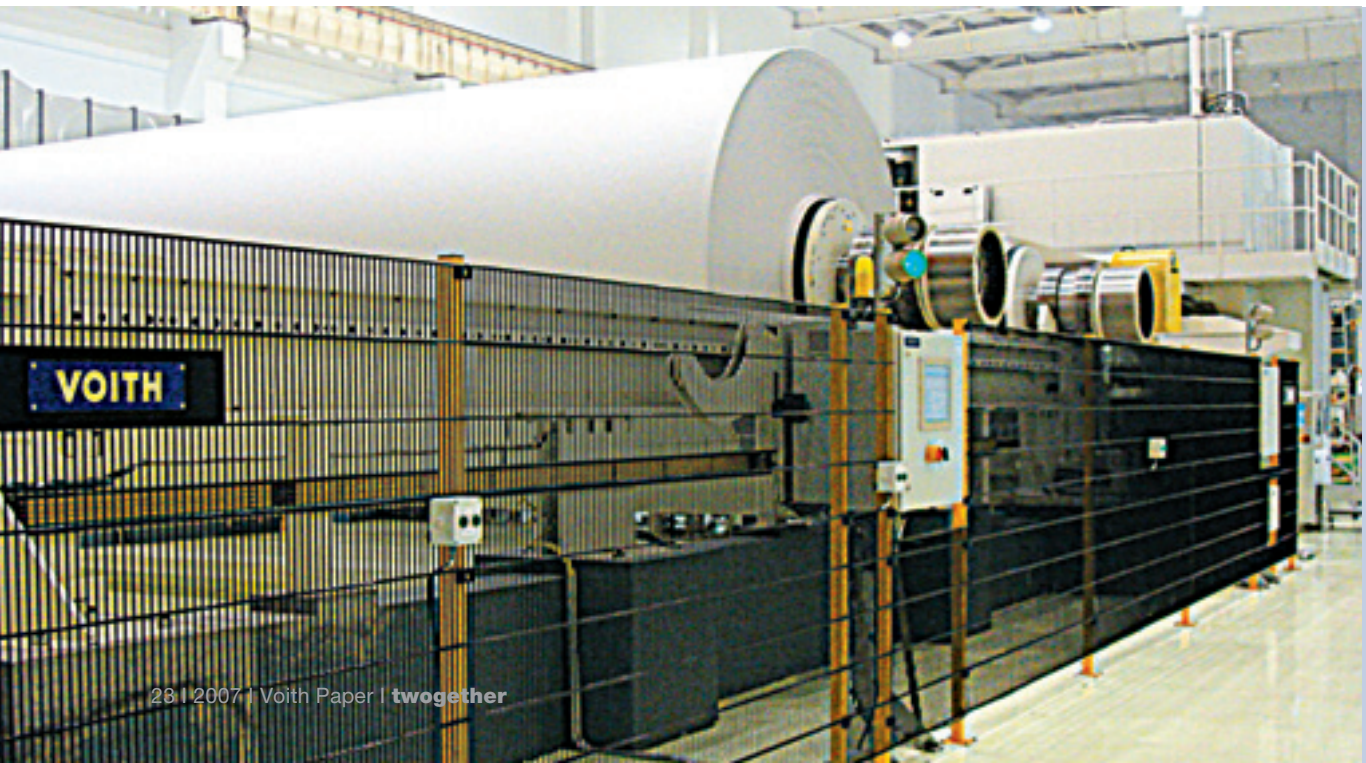
Wound paper rolls – also called parent rolls or full reel spools or just rolls – are getting much bigger and heavier these days. Weights of 125 t have already been reached (160 t will be attained in future), with web widths up to 11 m and roll diameters up to 4.5 m (or even 5 m in future). Such large rolls must be kept under precise control during handling and transport.

As explained in this article, Voith solves these problems by focusing in particular on the following:

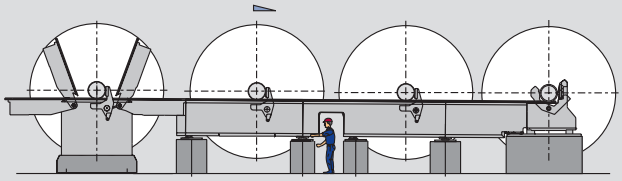
- Paper roll handling (transport tractor, rails and switches, roll magazine, roll turning)
- Paper roll trolleys.

The situation so far

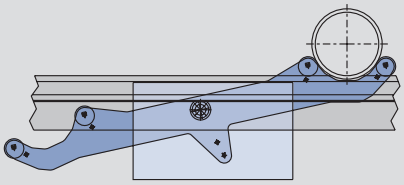
Paper roll magazines serve as a buffer between production stages. Rolls are stored there between the paper machine and offline coaters, offline calenders and winders if these



Paper roll magazine ahead of the VariFlex winder.



Line with conventional roll magazine.



Schematic view of roll tractor.

are all situated in the mill. So far the Voith paper roll storage concept has comprised two sets of rails installed in parallel, with a slight downward gradient in web run direction. The rolls travel down these rails as far as the next storage location or paper processing station. At the storage stations they are caught and held by a damping lever system until they are released afterwards for further transport.

Each magazine also has rail switches enabling rolls to be taken over from or transferred to upline or downline systems respectively. They also allow operator access to certain magazine zones.

In these present systems the paper rolls move freely from one storage point to the next, the only form of control being lateral restraint by the guide rails. Once a roll has been released by the lever system, it cannot be stopped until it reaches the next position. This freedom of motion can result in oscillations whereby the roll spindle ends impact the guide rails so heavily that the rails and spindle ends are subject to considerable wear and tear. Dependable operation of such a roll transport system depends on well-aligned guide rails, perfect condition of the roll spindles, and clean guide surfaces.

Roll trolleys transport the rolls at right angles to the web run direction, either between two lines operating in parallel, or between separate magazines. They also run on sloping rails, with a lever system to catch the rolls and rail switches for accepting or passing on rolls.

The challenge

The current state of technology had to be improved to ensure the controlled transport particularly of large heavy rolls, smoothly and well aligned to the guide rails. This requires the systematic application of controlled horizontal transport forces, precisely predictable and repeatable under all operating conditions. The principle of using a descending plane for moving the roll therefore had to be abandoned in order to eliminate uncontrolled roll motions.

Another requirement was restriction to a single form of applied energy as far as possible, but at any rate to use less maintenance-intensive systems that are also easier and faster to install.

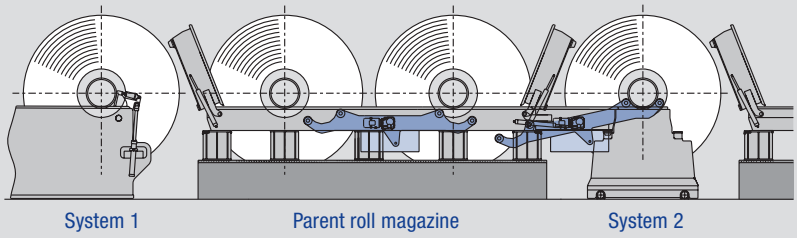
The solution

This challenge was met with a new concept. Although the paper rolls still run on rails, these are not inclined. The rolls are subjected only to precisely applied forces.

Instead of descending by gravity, the rolls are moved by a rail-mounted trolley – also known as a “roll tractor” – on each side. The guide rails for the tractor are incorporated in the roll guide-rail structure.

Each roll tractor has a centrally pivoted rocker beam, which in the horizontal position can be moved underneath a roll. The ends of this rocker beam extend out of the tractor on both sides, and can, in its tilted up position, pick up and move the parent roll. The beam projects enough for the tractor to transfer rolls to or from neighbouring systems without actually entering them. This greatly simplifies the interfaces between systems.

The tilting rail switches for roll acceptance, handing over and transfer are retained. They enable the connection of neighbouring systems to the roll magazine, and provide access



Line with new-generation roll magazine.

for maintenance and setup work prior to the further processing of paper rolls.

There are two ways of fixing rolls in the magazine. In the intermediate storage positions, a purely mechanical braking device stops even eccentrically wound rolls from moving. At other storage points where the rolls have to be rotated e.g. for winding off scrap paper, an adjustable wedge keeps them precisely positioned.

A new generation of roll turning devices has also been developed whereby the roll is rotated by a driver meshing with the teeth inside the reel spool. This ensures a fixed connection between the drive mechanism and the reel spool (instead of a frictional drive as previously). Rotation is kept under control by a disk brake, also mounted on the driver, that is much more effective than the friction brake used so far.

The trolley for transporting paper rolls between lines has been greatly simplified, and the receiving and transfer switches are now installed on the roll magazine. Rolls are fixed to the trolley by a purely mechanical device, in the same way as in the magazine, and they are received or passed on by the roll tractor. These changes eliminate many of the elements previously required on the lateral transport trolley, and no energy input is required except for actually moving the trolley. Communication with the neighbouring systems is by data interchange line.

Benefits of the new logistics system

- The fundamental advantage is precise system control, the basis for automation of the roll magazine storage system. And since rolls in the magazine can be transported in both directions if required, the storage logistics are much more flexible.
- Without the need for a hydraulics system, roll magazine installation costs are significantly reduced. This also saves planning and commissioning time, as well as maintenance costs later on (the entire hydraulics group on the roll transport trolley has been eliminated).
- Smoother motion of the rolls in the magazine saves wear and tear.
- The roll transport trolley has been greatly simplified.
- All interfaces are clearly defined.
- The dependable mechanical mechanisms used reduce system vulnerability.

Summary

By developing this new-generation roll storage magazine and transport trolley system, Voith Paper has not only met today's demands for handling bigger and heavier parent rolls, but also set another milestone toward the complete automation and optimization of finishing logistics.

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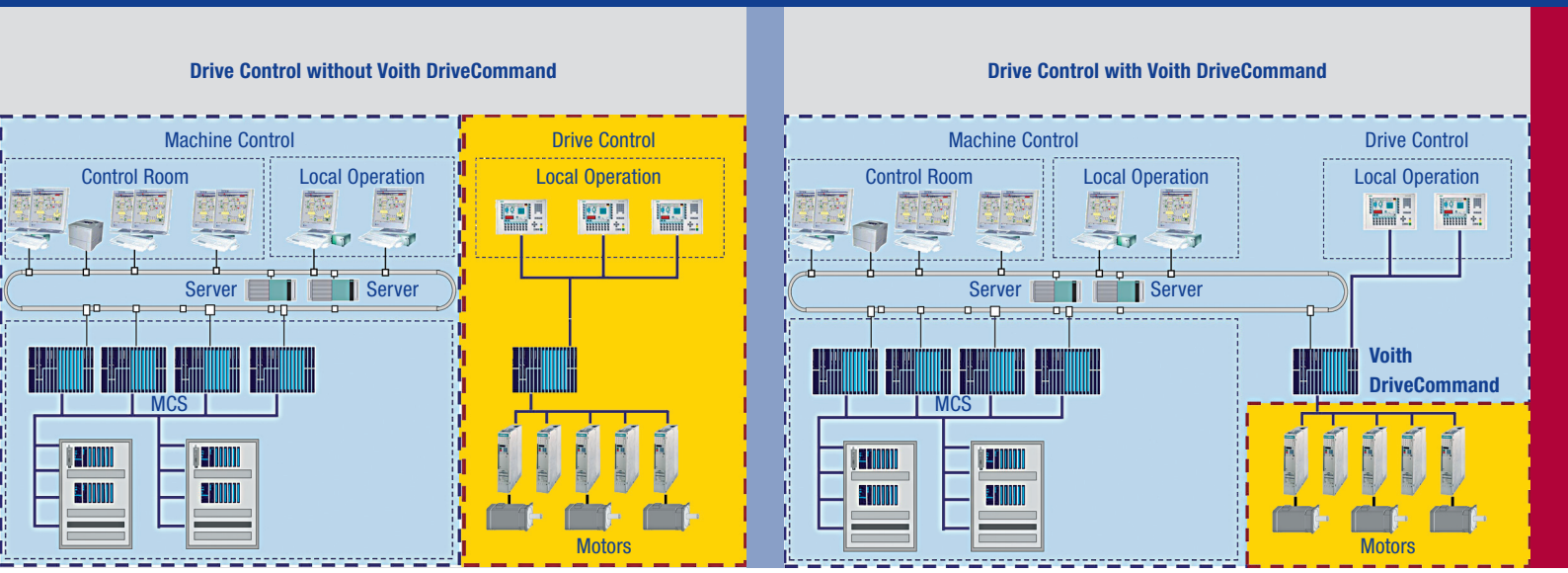
Voith DriveCommand – a major spin to totally integrated paper machine automation

Solikamsk and VDC team during Final Acceptance Test at Voith prior to delivery of the Voith DriveCommand.

Paper machines, satisfying recent standards in terms of product quality and productivity, become increasingly complex due to the installed subassemblies as well as the required precision-control. Voith has now the answer to the increased complexity of operation and maintenance of modern and high-capacity paper machines: Thanks to Voith DriveCommand the control of a paper machine will get quite simple. For the first time Voith realizes the total integration of the drive control. This is seen as an innovative solution for the needs of paper makers.

In the past machine motions and drive functionalities at a paper machine have been considered separately, although they influence each other. The Voith DriveCommand developed by Voith Paper Automation eliminates this separation by integrating the drive control into the process control system. Based on the process know-how for the whole papermaking process, which Voith has contrary to many other automation suppliers, a comprehensive and coordinated system has been developed. The Voith DriveCommand functions are combined with machine and process control functions for a higher performance control. The customer benefits from the single-source solution of Voith. On the one hand unnecessary interfaces in the program are eliminated and on the other hand the realization of the project is much more comfortable for the customer, because there is one overall responsible supplier.

Voith DriveCommand can be installed in new plants as well as used for modernizations for automation and drive systems. The strengths of Voith DriveCommand are very effective at modernizations, because the automation solution can be chosen independently from the drive solution (converters and drives). This allows the integration and control of drives originating from different suppliers



Voith has filled the gap in paper machine automation. In future the drive controls will be integrated in the machine control system.

and having different ages. Voith DriveCommand integrates the complete speed control and monitoring of the paper machine from the wire section to the reel into the standard Voith process automation platform. Voith closes the technological gap in papermaking automation, which up to now required the integration of a third party control, the drives supplier. Voith DriveCommand includes general functions such as jogging, crawling, normal run, stopping of individual PM sections or the entire production line as well as technological features such as tension control and load-sharing.

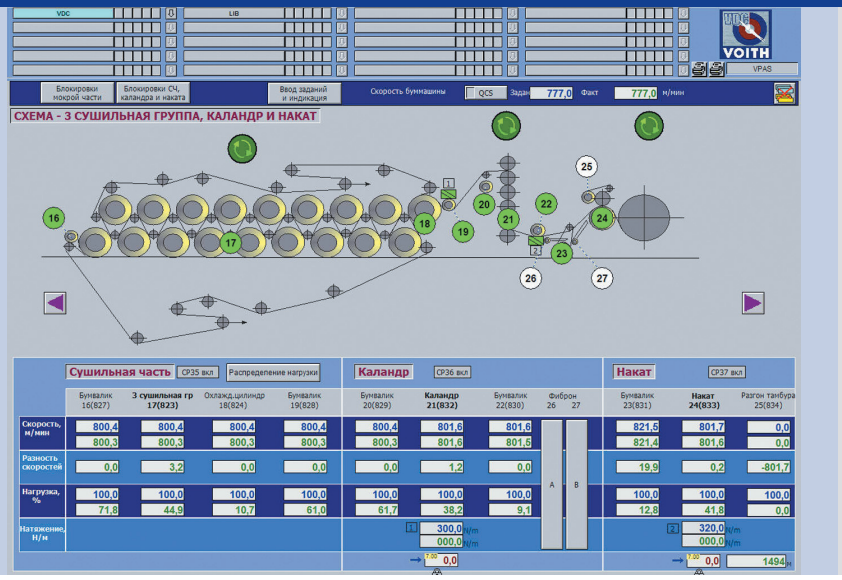
With Voith DriveCommand, the operators benefit from the same visualization platform and a uniform machine operation because all controls can be operated through one automation platform. In addition to this, the homogeneous process control and programming structure is very useful for the maintenance crew due to a simplified maintenance of the soft- and hardware. Thanks to Voith DriveCommand the service team does not have to maintain different types of programmable logic controllers and put themselves into various programming philosophies because the Voith platform (PCS 7) will be used exclusively. This reduces different hardware components and demands for maintenance will be minimized.

Voith DriveCommand comes with a rapid data acquisition system for a fast and time-synchronous recording of drives data and other relevant process parameters. Due to the high resolution of the data acquisition system and via optimization algorithms based on Voith Paper's technology know-how papermakers will have a deeper insight in the process. This gained knowledge is the essential basis for trouble-shooting: It can be used by the paper or board producer for production analysis and for the tracking of quality fluctuations caused by drives allowing countermeasures to be initiated. This leads to a continuous process improvement.

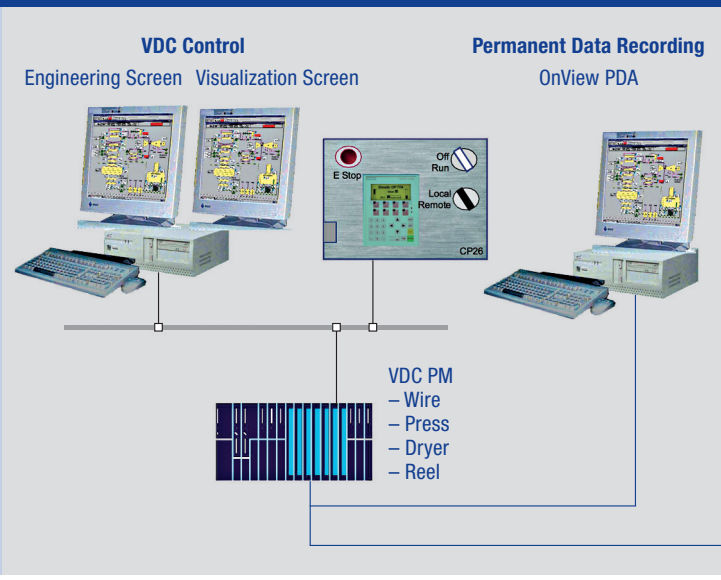
Compared to existing drive control solutions another feature makes the Voith DriveCommand unique: The testing on a comprehensive process simulation prior to delivery. This paper machine simulation calculates, based on the received nominal speeds and torques from the Voith DriveCommand, the full dynamic reaction of the drives with the connected gearboxes, rolls and fabrics.

Special care was taken to the accurate simulation of the paper behaviour during threading and normal run to identify the paper's influence on the drive dynamics. A highlight of Voith DriveCommand is the possibility to simulate changing production conditions such as changes of vacuum levels in the wet end, change in press-nip loads as well as variations in web tension or sheet breaks.

Thus, it allows Voith to analyze in detail the dynamic behavior of the paper machine and to tune the reaction of the Voith DriveCommand already prior to start-up. This ensures a smooth installation of the Voith DriveCommand and simplifies the start-up.



Typical visualization screen of VDC.



Connection of VDC to simulation for testing of individual VDC functionalities.

Benefits of Voith DriveCommand for the paper makers can be realized through the following components:

Process Control

The application software calculates for each individual drive the nominal speed/load, which is typically transmitted to the drive system via Profibus. In return, the individual drives send the actual load and speeds as well as the information of the actual drive status and alarms. This information, permanently monitored by Voith DriveCommand, is used in the internal control as well as for display on the visualization stations.

Visualization

As mentioned before, Voith DriveCommand is based on the PCS 7 platform. The visualization will be directly integrated into the process control system. Voith's special drive faceplates allow a direct examination of the drives just by clicking on the drive icons displayed. All relevant status and alarm information required for safe machine run are shown.

Rapid Data Acquisition System

This system, specially designed with open interfaces to various kinds of bus communication, traces the actual parameters such as speeds, loads, status information with a time resolution down to 1 ms.

Additionally, the system permanently records the internal parameters of the Voith DriveCommand and the connected machine control system. That means that permanently about 200 to 800 parameters are recorded at the same time and with high time-resolution. The analysis of the acquired data is the basis for tuning of the control system as well as the development of new technological functions.

Safety Control for Accident Prevention

Voith DriveCommand reflects the high Voith standards to insure human safety. Voith DriveCommand integrates the whole engineering of drive alarming and the required equipment such as signal horns and flashlights.

Optionally, the whole emergency stop concept of the production line is supplied, including the required local emergency stops and the safety control cubicle.

First Application for Solikamsk PM 1

The first application for the paper mill JSC Solikamsk Bumprom in Solikamsk, Russia reveals the potential of the Voith DriveCommand especially for modernization of drive systems. The drive system of the paper mill is very heterogeneous with partly re-

Simulation of complete PM 1
Simulation PC

Simulation of:
– complete dynamic behavior
– exact drive interface

In future all controls including drive control will be integrated in the same operating system.

maining ABB drives, which have to interface with a special adapter (serial <> Profibus) and new Voith supplied drives with a standard Profibus interface.

As Voith DriveCommand is open to diverse interfaces, such configurations are no handicap, open the customer economic modernization possibilities and allow to choose his preferred drives independently from the applied automation solution. Inside the Voith DriveCommand, the control takes care that varying reaction times of drives due to different age and manufacture are compensated.

Visualization was designed with the objective to allow intuitive and self-explaining handling. A typical HMI screen, as shown in the figure above, represents a clear overview of the actual drive status, with details available just by clicking on the individual drives. The visualization includes equally overviews of drive status, load and speed in graphic form as well as the visualization of the emergency stops in the production line.

During the factory acceptance test at Voith an intensive test of the Voith DriveCommand has been carried out by combining the system with an extensive simulation of the real PM 1.

Coupling the Voith DriveCommand with the simulation makes an intensive training of the operators possible to prepare themselves perfectly for the start-up of the new system.

Summary

Voith DriveCommand – the integration of the speed control into the Voith automation platform – allows the paper industry customer to benefit from:

Single automation platform for process, machine and speed control with
- unified machine handling (HMI) in one system
- simplified maintenance of software and hardware
- minimized spare parts requirement.

Improved machine control and automation system
- through the combination of machine and speed control
- due to increased process transparency because of the high resolution of the data acquisition system
- via optimization algorithms based on Voith Paper's technology know-how.

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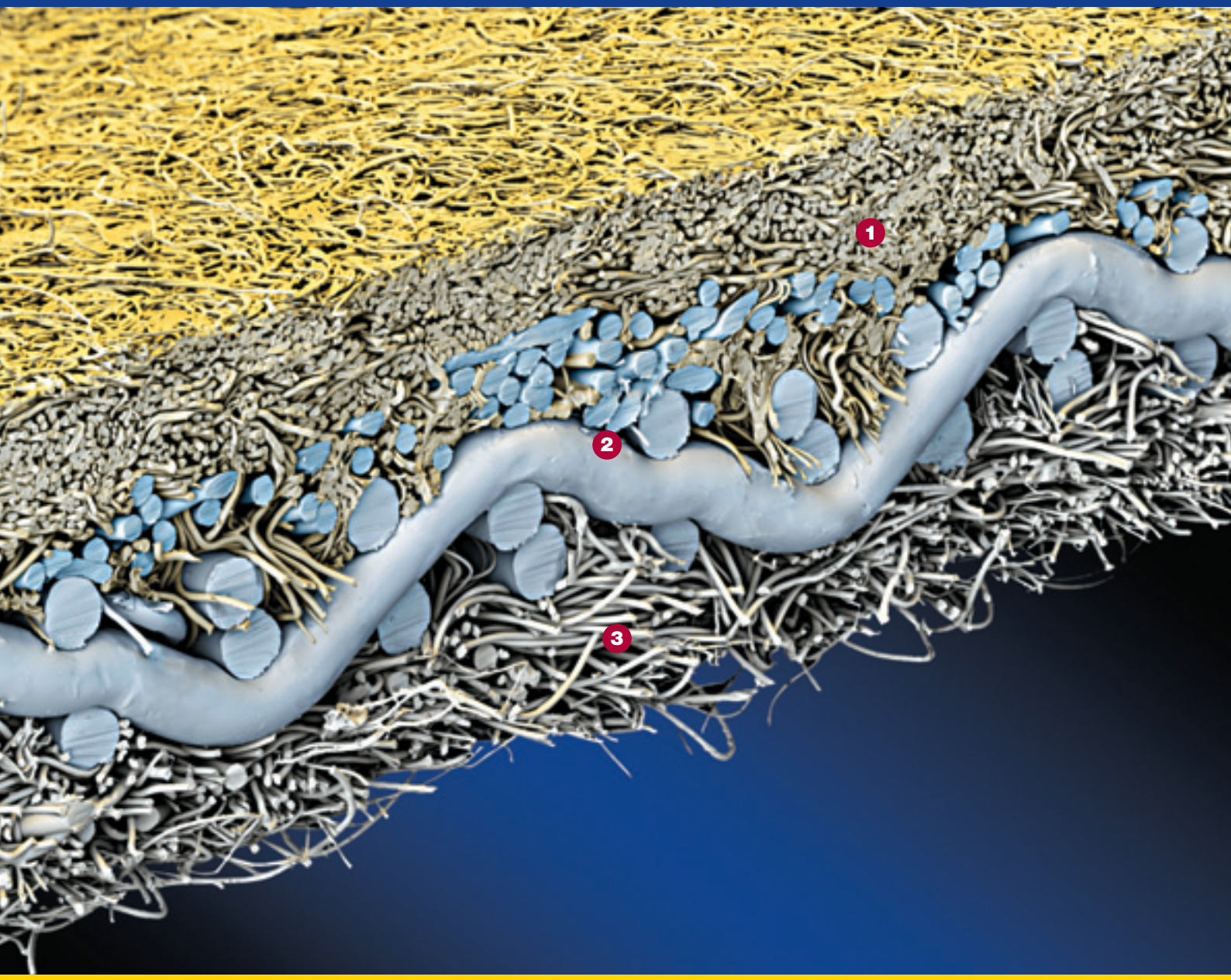


Fabric cross-section
1 Compressible top layer (fine)
2 Incompressible basic weave structure (here woven)
3 Compressible bottom layer (coarse)

PrintFlex PRO – For the finest possible pressing

As a member of the Voith Paper group, Voith Paper Fabrics is the only machine clothing supplier to offer the enormous advantage of in-house synergies covering the entire spectrum of papermaking technologies. This greatly benefits fabric research and development.

Voith Paper Fabrics' products can be tested from initial concept to commercial maturity under realistic operating conditions at the new Paper Technology Center (PTC) in Heidenheim. Because of this, Voith Paper Fabrics' customers have the benefit of optimal security and testing before trialing new products.

In the papermakers' never-ending quest for ways to improve their processes, 2-sidedness, printability and energy consumption are at the forefront of their mind. Fabric characteristics play an important role in this connection and innovative fabric designs can address these concerns. Fabric designs can be made to meet or even exceed these improvement requirements. As with many advanced technologies, however, this sometimes comes at the expense of useful fabric life. In other words, some innovations are simply not cost effective.

The short life of such highly specialized fabrics reduces their cost-effectiveness because of the additional outage time needed for more frequent fabric changes, often canceling out the potential profitability of paper quality improvements. A lot of fabric producers, therefore, have no other choice with new developments but to meet papermakers' requirements increments at a time – always at the risk of neglecting one of the key aspects mentioned above.

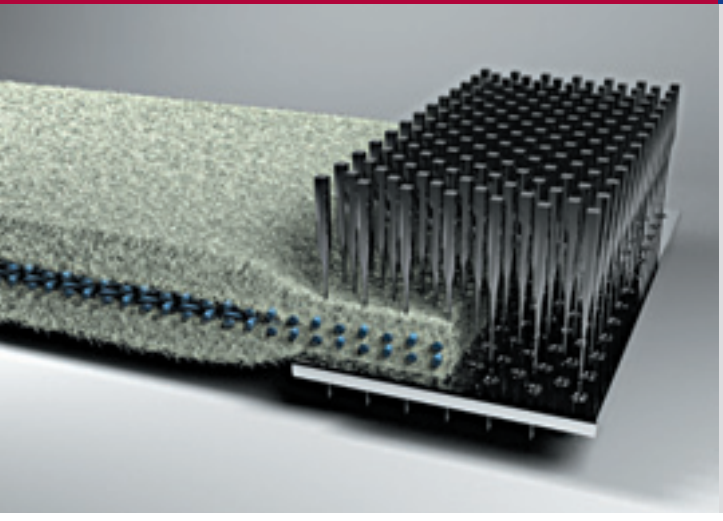
With innovative machine clothing, Voith Paper Fabrics has proved that they can significantly improve paper quality and machine runnability while maintaining cost effectiveness.

PrintFlex PRO, our latest development for the European and Asian markets, carries us further on our journey to complete customer satisfaction. The ongoing analysis of customer demands on paper surface quality led to a more intensive examination of each press fabric during the manufacturing stage.

The main findings were that nonwoven production, the weaving process and the fixing procedure have the greatest affect on the fabric surface and the end product.

- Nonwoven production: selection, fineness and fiber combination
- Weaving process: speed, density/design
- Fixing procedure: speed, temperature and type/method of fixing.

Needling.



Press Fabrics

As shown in the Fig. "Fabric cross-section," press fabrics comprise a compressible layer (non-woven) and an incompressible basic weave structure. The non-woven layer is made up of polyamide fibers with various diameters and properties, and serves mainly for paper sheet dewatering. The basic weave structure provides mechanical strength (e.g. tensile strength) and water storage volume.

As shown in the Fig. "Needling," during fabric production the non-woven layer is laid loosely on the basic weave structure and then fixed to it by needling.

PrintFlex PRO advantages

Problems have arisen when using the finest fibers for press fabric production, because they did not have enough abrasion resistance during machine operation. This was not only evident from the small fiber particles found in the paper surface, but also from the unequal substance losses that interfered with drainage behavior. On the one hand abrasion has something to do with the fiber diameter, but on the other hand – and verifiably to a greater extent – also with the way the fibers are bonded into the fabric structure: the smoother the surface, the lower the wear tendency. Thanks to innovative development and optimization steps in press fabric production, Voith Paper Fabrics has successfully bonded the finest fibers in the fabric surface contacting the paper. As a result, the fine fibers incorporated in PrintFlex PRO fabrics do not penetrate the paper surface. And the finer the fibers, the less risk of sheet marking. PrintFlex PRO fabrics are particularly beneficial on the last presses, where the web dryness is already so high that paper fibers are no longer likely to be displaced.

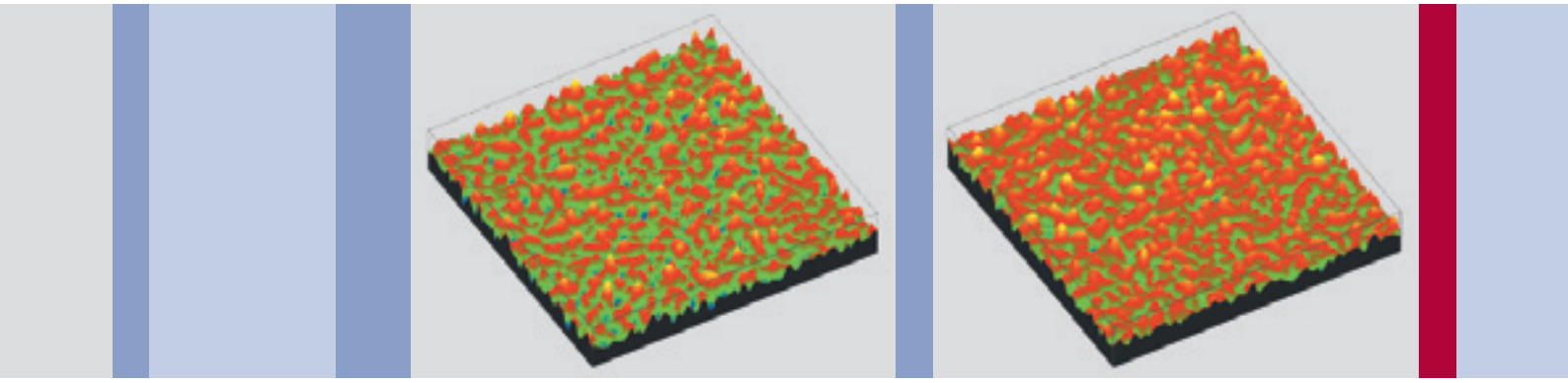
Thanks to a far greater number of contact points, the PrintFlex PRO fabric surface is consistently homogeneous. This results not only in excellent fabric startup behavior and uniform drainage, but also in decisively better sheet quality.

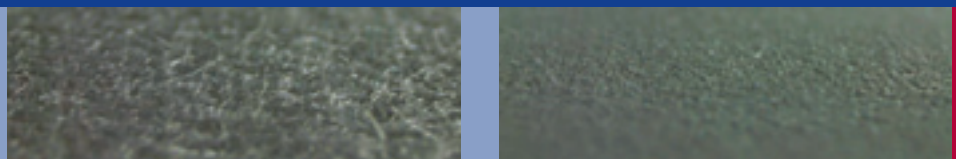
By incorporating the finest fibers, a compact non-woven layer is generated. The resultant micro-pore structure hardly changes under pressure, so that fabric startup times are considerably reduced. The optimal, homogeneous press fabric structure gives the finely pored surface on the paper side a strong supporting layer that immediately absorbs drainage. This prevents the air pockets that otherwise cause bubble formation in the paper sheet at nip entry.

Furthermore, the aforementioned structural characteristics of this fabric ensure trouble-free sheet threading and eliminate the problem of edge curling.

The illustrations above clearly show the superior surface quality attained with PrintFlex PRO compared to a standard press fabric. Above all, thanks to optimal fiber bonding on the fabric surface, marking is minimized and fiber losses are reduced.

Topographical surface of a standard press fabric compared with that of PrintFlex PRO fabric (on the right).





Paper-side surface of a standard press felt compared with that of PrintFlex PRO felt (on the right).

Measurements of the surface characteristics (below on the left) clearly show the comparative topographical improvements attained. While the old standard fabric exhibits significant indents on the paper side that cause marking on the sheet surface in the press nip, the new fabric has a greater support surface area thanks to surface displacement in the z-direction toward the paper web. This provides much more homogeneous sheet support. As a result, the printability of paper dewatered with PrintFlex PRO is significantly improved.

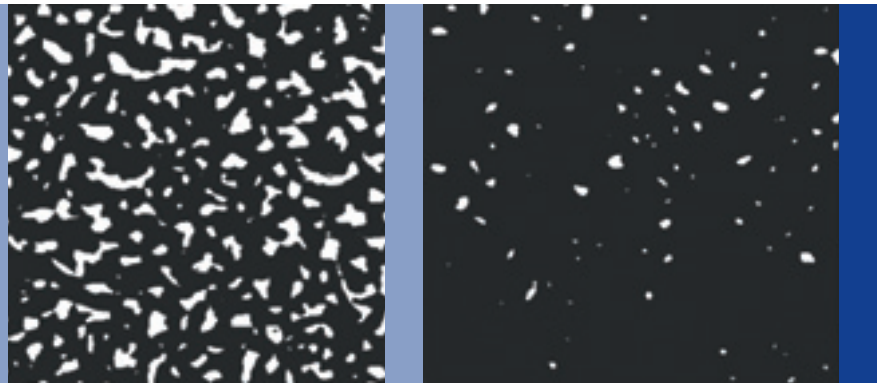
The illustration below on the right shows a horizontal cross-section through the topographical surface profile, 30 µm below the highest measured peaks. Far more peaks (white dots) are visible in the standard fabric than in the new PrintFlex PRO. This is further proof that both the smoother fabric surface and the better fiber bonding consistently reduce sheet marking in the press.

As confirmed by pilot tests at the Heidenheim Paper Technology Center as well as by market feedback, the PrintFlex PRO development has met its claim and is the optimal fabric to achieve sheet smoothness in press positions.

Summary

The new PrintFlex PRO, available in Europe and Asia, provides customers with a press fabric that is able to achieve the most demanding requirements on graphic machines. PrintFlex PRO combines the advantages of quick startup times and significant improvement in paper surface quality.

Topographical cross-section of a standard press fabric compared with that of PrintFlex PRO fabric (on the right) at a depth of 30 µm.



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SSB forming fabric production.

Effective forming fabric concepts – for economical paper and board production

Energy consumption is an increasingly important point of attention within the paper industry. Oil prices have reached all-time highs, driving up in turn the cost of energy, raw materials and additives. And at the same time, paper and board prices are under pressure. Rising costs and falling prices clearly mean less profitability. This article touches on some aspects where forming fabrics, especially SSB designs*, are able to help in reducing papermaking costs.

*** SSB fabric concepts**

SSB stands for Sheet Support Binder – the latest technology in forming fabric production. In contrast to conventional 3-layer forming fabrics, separate binding threads for holding together the individual layers are not required.

Forming fabrics

Forming fabrics are technical consumables in the process of making paper and board. The function of a forming fabric is to help the mills reach the required paper/board quality and achieve the highest paper machine runnability. Within time, constant innovations in forming fabric designs have helped make paper machines wider and faster while improving the quality and runnability requirements.

Forming fabric cost-comparison

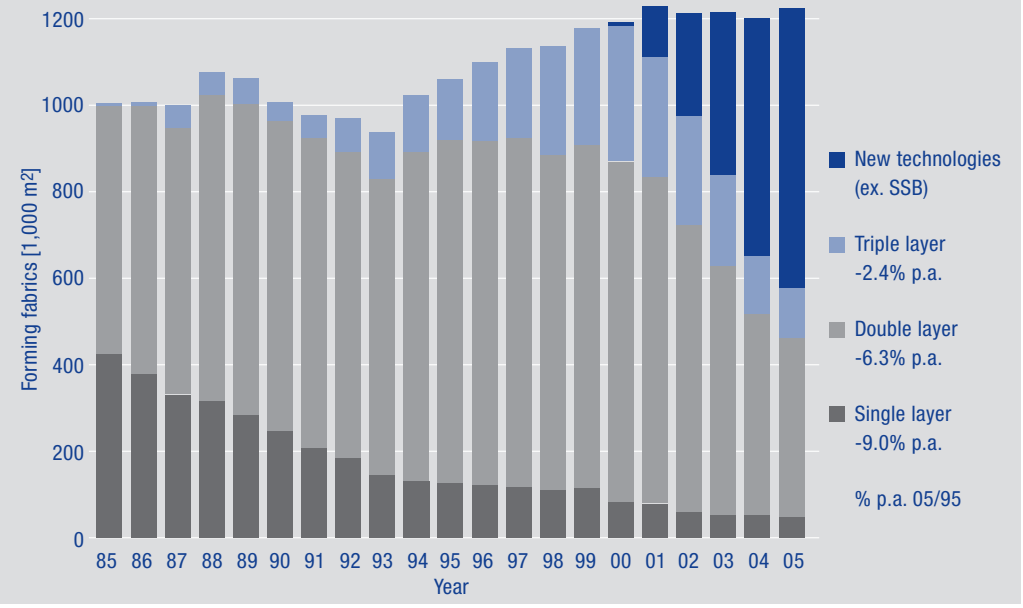
The contribution of forming fabrics to reducing costs can be viewed from two sides. There is, of course, the price of the forming fabric itself. The price is normally dependent on the design, the dimensions and the possible options applied. Secondly, there are costs that can be reduced by applying a particular forming fabric design. A forming fabric is a technical product that has a big influence on runnability, energy, raw material and additives costs.

A good way to judge the forming fabric price is to use the specific forming fabric cost in Euro/1,000 tons of paper produced. The specific cost can easily be calculated by multiplying the specific forming fabric consumption (m^2/1,000 tons of paper produced) by the forming fabric price per m^2 (Euro/m^2). Working with the specific forming fabric price has been a real eye opener for many people who often come to premature conclusions based merely on the price of the fabric.

Specific forming fabric consumption

Modern SSB concepts have significantly decreased the specific forming fabric consumption. The share of SSB concepts has increased from just below 10% to over 50% from 2001 to 2005. At the same time, the specific forming fabric consumption for all designs has decreased overall from 14.3 m^2/1,000 tons to 13.0 m^2/1,000 tons, a reduction of nearly 10%**.

Forming fabrics total deliveries in Western Europe (Plastic only 1,000 m^2)**



*** Source: PCA, statistics bulletin no 12 – September 2006 – Western Europe only*

Forming fabrics cost-savings potential

Apart from the specific forming fabric price, the savings that can be attained by applying the most suitable forming fabric design are far more interesting. Optimally fulfilling the two main functions of a forming fabric (paper quality compliance and PM efficiency) not only brings substantial savings thanks to higher paper machine efficiency, but also reduces energy, raw materials and additives consumption.

SSB fabrics – the optimal solution

Contradictory needs and wishes regarding the wet end of a paper machine often mean making a compromise. Currently, the SSB designs hold the lowest concessions and the highest possibility of helping paper mills reach the required paper/board quality, achieving the highest paper machine runnability and most economical production. SSB fabrics with their special advantages optimally support our customers in reaching their requirements, and, therefore, bring the highest potential cost savings for the wet end.

Introduction of the SSB concept has lead to an increase in paper and board quality and better machine runnability. In the graphics sector, where there is a high percentage of recovered paper, the conventional three-layer designs cause quality problems,

i.e. marking and roughness, and sometimes lead to poor runnability through delamination problems and limited life potential. Therefore, this part of the industry was more or less forced to stick to double-layer designs. The SSB designs are now able to eliminate these negative effects while improving formation, Z-direction fines/filler distribution and runnability.

Other cost parameters

SSB designs have made it possible to boost machine runnability and reduce the amount of costly raw material and additives. Machine efficiency is increased as a result of cleaner run and better water handling. Formation is improved due to the ability to apply less retention aid, run at higher speeds without risk of marking, and ensure a more controlled water handling. Smoother paper and board surfaces and more uniform Z-direction filler/fines distribution has led to savings on coating/starch consumption, and less waste due to blackening.

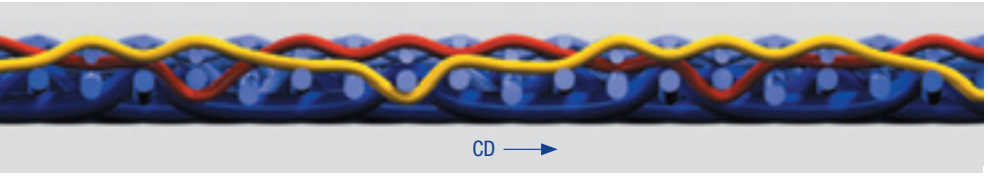
Operating media consumption

Apart from raw material and additives, paper machines also need energy and other operating media. The different types of energy and media consumed on and around a wire section are electricity, vacuum, hydraulic, air, water, and sometimes steam. Significantly influenced by the applied forming fabric design are the consumptions of electricity, vacuum and water. Electrical power is required for driving the fabric, vacuum is required for dewatering and sheet transfer, and water is used to clean the fabric or for sheet knock-off.

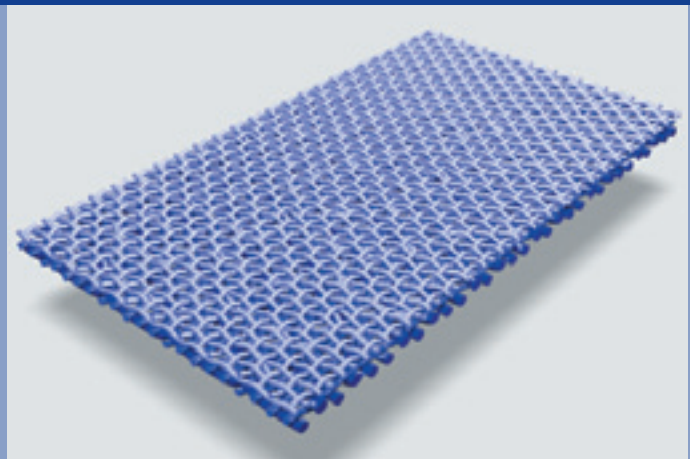
The right choice of a fabric can significantly decrease power consumption. A fabric design with an open machine-side structure undergoes less resistance from the dewatering elements, and, therefore, consumes less operating power. As a rule of thumb: the percentage decrease in number of wear side cross direction yarns corresponds to the amount of electrical energy saved. Optimal energy savings are achieved here by using modern SSB designs with paper side versus machine side weft yarn ratios bigger than 1.

Vacuum is used for dewatering and for transferring the sheet. The majority of the energy is consumed by the high vacuum elements. Fabrics that stimulate homogeneous sheet formation during the dewatering process, thanks to their surface design and pulse transmission, are likely to need less vacuum. During sheet formation the open sheet structure is retained in the forming section and facilitates dewatering through the suction couch roll. A forming fabric with a fine paper side and a high open surface area with the right air-permeability range will help with this aspect. An additional advantage of such a design is that less power is required for driving the fabric.

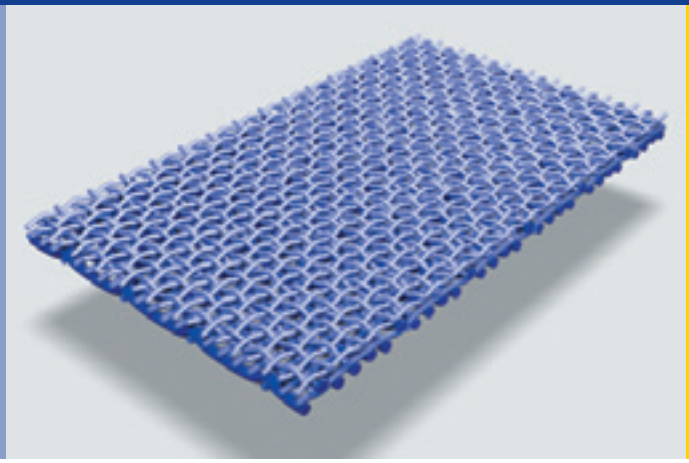
Water is used among other purposes for keeping the fabric clean and for knocking off the sheet. If the forming fabric is designed in a way that allows it to run cleaner, then naturally less cleaning is required. High-pressure spray pipes with smaller holes can then be used, and in many cases they are even replaced with periodic use of e.g. a Voith DuoCleaner. Thin forming fabrics with low internal volume require less water to knock off the sheet. In both cases less fresh water is used, thus enabling significant cost-savings potential. As mentioned, fine forming fabrics with high paper side support and open wear sides offer the best savings potential.



Binding weft thread pattern in an SSB fabric design.*



PrintForm HQ.



PrintForm HR.

Well-proven products

Voith Paper Fabrics has a strong new SSB product range known under the names PrintForm H and MultiForm H. Within this range we have two unique products: the PrintForm/MultiForm HQ and HR. The PrintForm HQ can be placed in the "fine" segment of SSB designs. It is a design applied typically in the graphics area for high-quality grades.

The MultiForm HR is a somewhat more robust forming fabric design, specially conceived for high-quality packaging grades (corrugated board). They both provide the ultimate support for our customers' requirements, and offer a high cost-savings potential thanks to their fabric design.

PrintForm HQ, MultiForm HQ

The distinguishing characteristic of Voith PrintForm HQ and MultiForm HQ forming fabrics is their low warp density and high number of cross directional yarns. This results in extremely good sheet support. The HQ designs have a relatively coarse machine side with high shear and cross directional stability, which makes for long life potential. The applied high shed weaving technology (see twogether 21, p. 58 ff.) gives a mark-free structure. By selecting the optimal design, cost savings can be achieved in clean running, additives use, vacuum, water and power consumption.

PrintForm HR, MultiForm HR

An important advantage of MultiForm HR and PrintForm HR forming fabrics lies in their open warp density, resulting in the same advantages as with the HQ fabrics. Another advantage of this design is that the wear side holds long cross directional weft flotations, giving the fabric long life potential. The floats go over 8 instead of the more usual 6 or 5 warp threads. Here again, selecting the optimal fabric design brings cost savings in clean running, additives use, vacuum, water and power consumption.

Summary

SSB forming fabrics offer huge savings potential in the wet section. The somewhat higher price of SSB fabrics soon pays off thanks to the resultant savings in and around the forming section. These savings are due not only to the higher machine efficiency, but also with regard to raw materials use, additives consumption and power consumption.

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NipMaster and NipSense help papermakers improve machine runnability

The importance of roll covers on paper machine efficiency and paper quality has already been extensively reported in previous issues of twogether Magazine. Voith Paper Rolls is developing new covers fulfilling future requirements (higher machine speed, reduced energy consumption, better paper quality, ...) of the paper makers.

Strong application expertise in cover selection, design and on-site support, is required to obtain the expected performance and all potential benefits for the papermaker, in term of machine efficiency, total cost of ownership and paper quality.

Application know-how includes paper making process understanding, roll cover properties and their impact on the paper making process, as well as calculation and measurement tools.

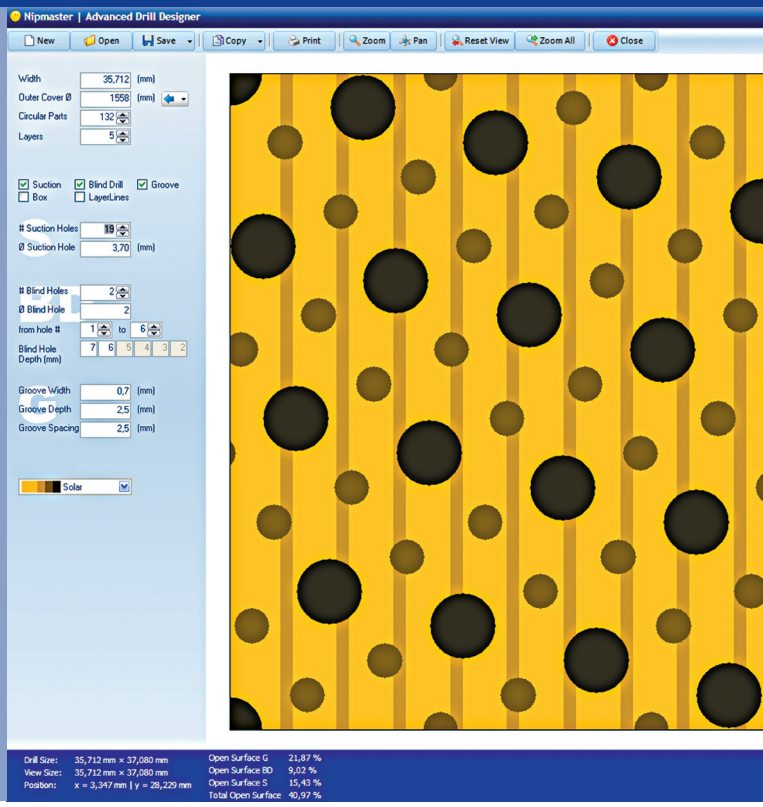
The purpose of this article is to report on NipSense and NipMaster, some of the major tools used by the application engineers of Voith Paper Rolls for ensuring successful operation of roll covers.

The key applications of roll covers are pressing the sheet for dewatering, apply starch or colour, and calendering. Therefore it is of prime importance to understand and predict the process in the nip: peak pressure in the nip, nip width, heat generation, cooling requirements, absence of non-uniformity in cross machine direction, and absence of overloads to avoid cover failure.

Soft press and suction roll covers have to be designed to offer the required storage volume for nip dewatering, at the end of the felt life and after several regrinds. The pressing has to be uniform in the cross-machine direction for uniform dryness.

Michael Weinzettl and Mike Radtke, polyurethane roll cover product managers and specialists of nip dewatering, report how a suction press roll cover is designed and optimized with NipMaster in its operation.

Nip Calculation.



Surface Design.

Step 1: assess the type of paper produced, operating conditions, press configuration, type of felt used, felt and roll conditioning, moisture in the felt.

Step 2: with NipMaster, our new roll cover design, calculation and measuring software assess the current operating situation using as input those parameters.

Step 3: define most appropriate roll surface design for customer expectations (uniform dewatering, increased dryness, elimination of shadow marking by reducing hydraulic pressure in the nip or allow higher machine speed without loosing dryness).

Step 4: make a water balance calculation and define improvement potential in dewatering.

Step 5: define limits of safe operation. The calculation engine developed by Dr. José Rodal, VP R&D North America, to solve the nonlinear contact problem of dissimilar multilayer viscoelastic covered rolls is run for the assessment of the stresses, strains, temperatures and other important press roll engineering parameters under current or future conditions of paper machine operations. Reports on some of the capabilities of the computing program has been given at the 2005 TAPPI Papermakers Conference.

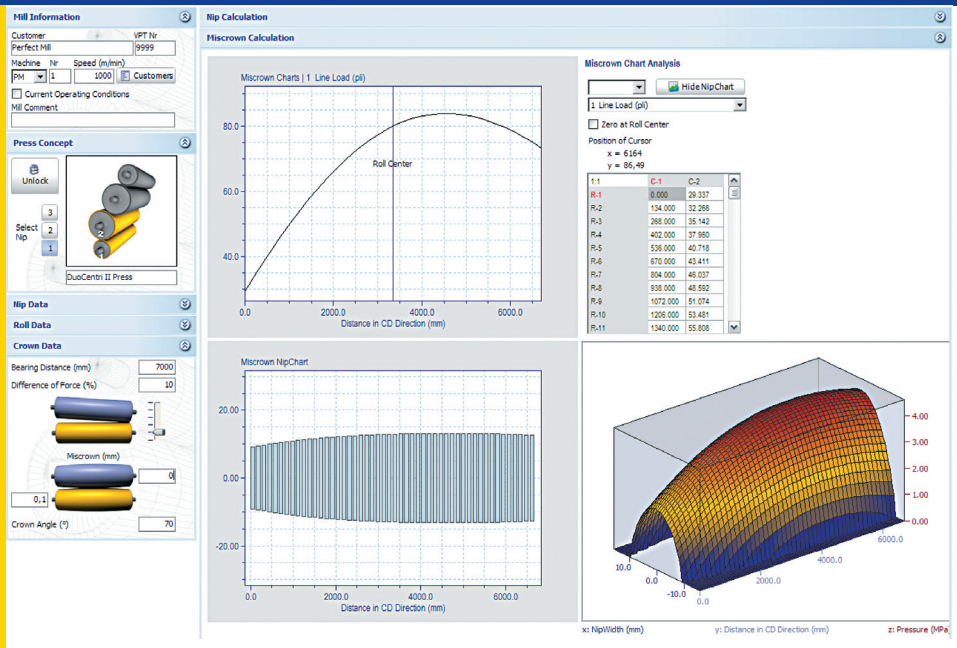
Step 6: give a final recommendation and cover argumentation. It is known that two identical paper machines may not always produce the same end result. Therefore the task of the application engineering can not end with design calculations and measurements, but it is very important to continue with start-up support and follow-up of operation.

Key activities include:

- Assessment of nip conditions
- Checking roll and felt conditioning
- Checking operation temperatures
- Checking doctoring.

A key tool and new development for assessing the nip conditions is the NipSense instrument for electronic nip measurement, which uses a new generation of sensors and intelligent microchips to achieve superior accuracy.

Because Voith designs and builds press sections, Voith Engineers have unmatched expertise in the optimization of nip profile. NipSense complements this expertise with patented technology that provides the same resolution in the Cross-Machine



Nip profile resulting from a miscrown.

Direction as prescale film scanning, but in real time. Real-time display technology shows actual nip-width variation with time as load is applied on rolls. NipSense systems have a minimum of 32 sensors in the cross-machine direction but NipSense can also be deployed with 64 or more sensors in the cross-machine if desired. This greater resolution allows precise solution of nip profile problems. Wireless connectivity allows you to make load adjustments while you look at the resulting nip profile.

NipSense proprietary technology involves intelligent microchips that monitor the health of the sensor and connections, as well as eliminating the need for calibration.

NipSense allows measurement of 3 nips simultaneously. The ability to measure on-line 3 nips is a great way to visualise the very complicated influence of one nip to the other in a cluster press in a minimum amount of time.

Before deploying this new electronic nip measurement device around the world, extensive field trials have been conducted with great success.

The NipSense measurement is coupled with the NipMaster computer program, allowing to use the same set of parameters for both measuring and calculating the nip situation. Effect of overload can be computed. The calculation engine is able to calculate the stress distribution within the cover in case of overload and assess the risk of cover damage, and also to compute the pressure distribution in cross machine direction and the effect on sheet pressing and dewatering in cross machine direction.

The successful optimization of a press was demonstrated at a producer of newsprint. The producer installed an Aqualis suction roll cover (blind drilled and grooved) on the DuoCentri II-type press. This replaced a grooved suction roll that needed recovering. The cover was 5 P&J and had a custom designed pattern with 41.5% open area.

Immediately after start-up, the average press section draw came down from 2.7-2.8 % to 2.3-2.4%. An extra bonus with the Aqualis was that the mill was able to significantly shorten their felt break-in time. The machine is speed limited at 1,275 m/min (4,186 fpm) because of the suction couch roll drive, but with conditioned felts, they have seen their steam consumption reduced between 4-7% depending on the days. This represents approximately 2,000-3,000 kg/h of steam savings (at a value of over 200,000 € / $ 250,000 per year).

Contact Voith Paper Rolls for details and starting a program for optimizing the runnability of the roll covers in your machine, increase your efficiency, reduce the unplanned shut-down risk and costs or improve your paper quality combining your paper making know-how with our application experience.

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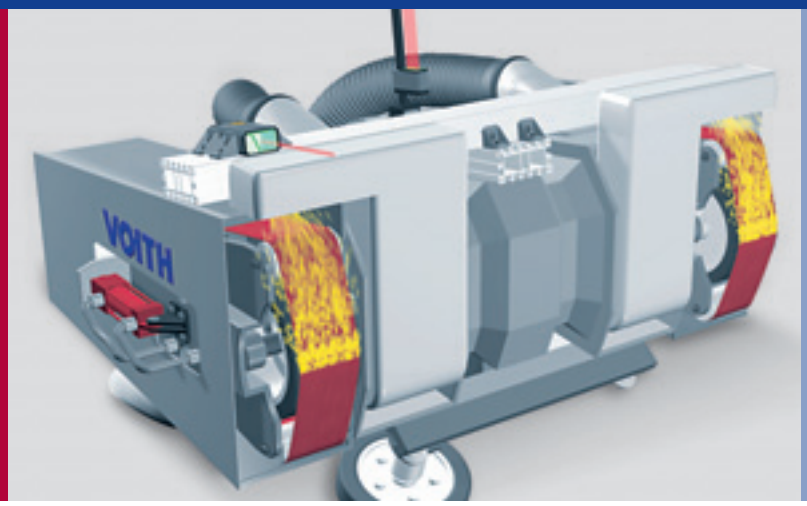
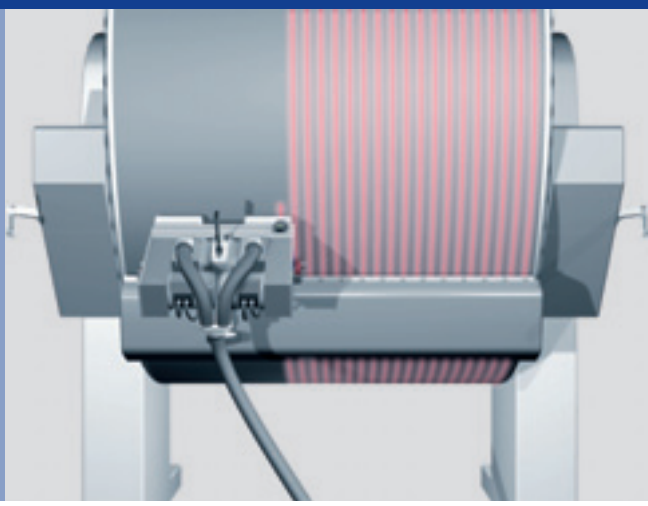
Profile Maintenance Program utilizing Virtual Reference Grinding (VRG)

The recent development by Voith Paper's Tissue Cylinder Services group of its Virtual Reference Grinding (VRG) technology has truly revolutionized the way Yankee and MG cylinders are ground. By combining scanning lasers with computerized control of grinding forces, the VRG has set a new standard for speed and accuracy in the grinding of crowned or profiled cylinders in the field.



VRG system.



Helix surface measurement.

This technology has led to a re-examination of the practices concerning the planning of Yankee profile grinding. The new paradigm is the Profile Maintenance Program (PMP). PMP takes advantage of other planned maintenance outages to complete a profile maintenance grind in 24-32 hours. By adopting this program tissue companies are embracing the philosophy of preventive maintenance. This as opposed to the run to "failure" practice currently used by many in the industry with regard to the condition of their most important assets.

The Yankee dryer is the heart of conventional tissue machine. Its crown or profile is critical in establishing the proper geometry between the pressure/dewatering rolls and the Yankee when it is under a full condensing load. The Yankee profile degrades over time due to the cumulative effect of process upsets. Yankees have been typically ground on a cycle that has been established with experience over time. Normally this cycle was based on the amount of time the machine could run before problems with moisture control, edge breaks and picking made a significant impact upon the machines efficiency. The focus was on extending the runtime as long as possible to avoid the 2-3 days downtime required to complete a full profile grind. A typical grind removes, on average, 0.030" from the radius of the cylinder. Often mills over estimate the amount of run time required to get to the point of significant machine impact caused by poor conditions of the Yankee's profile. This can result in weeks or even months of reduced paper machine efficiency and off quality production.

With the development of the VRG, crown profiles can ground by a system that mounts directly on an existing doctor blade holder. This doctor mounting eliminates the need to remove pressure rolls and other heavy paper machine components. This compares to the efforts required to prepare a machine for the previous Tangential Grinder (TG) technology which utilized a heavy platform bed that weighted 14,000 lbs!

A typical mill can save 12-24 hours of pre and post grind machine preparation work when using the VRG for a typical grind. Another advantage of the VRG is the unparalleled level of documentation included in the grind package.

The VRG system gives complete topographical scans of the drying cylinder before, during and following the grind. This allows the mill to evaluate the condition of the cylinder before the grind to determine any unusual wear conditions which might indicate a problem with the condensate removal system or the coating sprays etc.

Experience has shown that the wear rate overtime for the Yankee surface is not linear. As the miss-crown condition increases between pressure rolls and the Yankee and as operators make doctor blade adjustments to cope with low/high moisture areas, the wear rate accelerates.

Yankee Wear Rate.

	Number of grinds	Downtime hours per grind	Total downtime for profile grind	Material removal /grind	Total removed	$ per grind	Total $
Current 24 month cycle	3	60	180	0.030“	0.090“	$ 50,000	$ 150,000
New 18 month cycle	4	30	120	0.015“	0.060“	$ 57,500	$ 230,000
Hours saved		60					
Increased grind cost							**$ 80,000**
Machine time ($/hour)							$ 5,000
Based metal savings					**0.030“**		
Total downtime savings						**$ 300,000**	
Efficiency savings in last 90 days before grind $ 2,400 (per day) x 90 (days) = 216,000 x 3 (regrinds) = $ 648,000							**$ 648,000**
Total 6 year savings							**$ 868,000**

Profile Maintenance Program savings. Time frame 6 years, 72 months.

As shown in the graph, the wear rate accelerates as the radial loss passes the .012'' point in the low areas. During the final 6 months of operation prior to grinding, the tissue machine usually experiences an increase in breaks and quality issues that are gradual but very persistent. Efficiency losses during this period which can have significant economic impact on the mills results. Due to the gradual nature of this degradation it may go unnoticed until the operation of the machine is effected to the point the mill can not longer put off the need to grind.

Many mills experience an increase in the amount of organic coating required to keep their machine running well during the final phase of the extended grind cycle. The additional cost of this chemistry can run several thousand of dollar per day when compared to usage rates just following the grind.

By adopting a Profile Maintenance Program (PMP) the mill can avoid reaching the accelerated portion of their machines wear curve. In the example from the graph, a grind is indicated at or before 18-19 months versus the previous practice of 24 months. The actual wear curve varies for each machine. But a rule of thumb is that a grind is most likely indicated at the 2/3 point of the historical grind cycle for each machine.

The table gives an example of the potential savings from adopting PMP practices. More frequent grinds of a shorter duration result in significantly reduced downtime over the sample period. A net savings of $ 868,000 in downtime (minus additional grind costs) was found in this example. Efficiency losses were valued at $ 2,400 per day for the final 90 days of the tradition grind cycle (including breaks, chemical usage, machine speed, quality issues).

These saving figures do not attempt to put a value on the savings of one additional grind worth of material base stock left on the Yankee by adopting a PMP. This reduction in base metal loss can considerable extend the useful life of the Yankee.

In summary, by adopting Voith's Profile Maintenance Program philosophy for your conventional Yankee dryer you can substantially reduce downtime associated with profile grinding, avoid efficiency/quality losses associated with miss-crowning, and extend the lifetime of this critical assets. At the same time you will receive all the benefits of the VRG's accuracy, advanced mapping and documentation capabilities.

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New Service Center now also in Chile

The maintenance and optimization service offered by Voith to the paper industry worldwide is highly appreciated and sets the standards in quality and reliability. Chile will now also have a new Service Center to help local paper and pulp producers to maximize their productivity, lengthen the intervals between maintenance works and optimize machine availability.

Investment in new paper and pulp mills in Chile has grown substantially in recent years. Realizing the need for high-quality service, Voith installed in early 2006 a new Service Center in Concepción, Chile.

Until then, no OEM service units were available in the country and paper mills were forced to have the maintenance services of their equipment carried out internally or through small local workshops or done in foreign countries.

The new service unit, the fifth of the Voith Group in South America, offers to the Chilean market Voith's know-how in the design, manufacture and, particularly, maintenance of equipment. Technicians with several years of experience, training and specialization acquired in other Voith units in Brazil now share their knowledge with the Chilean technicians, building with them a strong experts team. Besides that, the local team can easily connect with Voith's global specialists network to provide solutions for the complete paper making process.

Almost 2 years ago Voith started to look for a proper area in Concepción (530 kilometers south of Santiago) to built a new service unit. On October 26th, 2006 the opening ceremony for the new center finally took place. Invited customers were informed about the extent of the available services in a nearby golf club. A tour through the Service Center was followed by a short inauguration ceremony in the presence of many customers, members of the Chilean Pulp & Paper Association and local authorities. After that, cocktails with a Brazilian and Chilean atmosphere and a delightful lunch were offered. The customers left the place with confidence that Voith is now really rooted in Chile.

The Voith Service Center in Chile will fulfill the customers' needs, ensure the supply of services with the same quality found in more than twenty Voith Paper Rolls service units spread over the five continents, to support papermakers to be more competitive in the global market.

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"Life Cycle Partnership" presented in China – High interest in lasting partnership

In late September/early October 2006 Voith Paper China held three seminars in Qingdao, Shenzhen and Shanghai for paper industry customers in these regions. The interest was so high that 250 customers from 60 large and medium size companies attended these events. Among the leading Chinese papermakers welcomed by Voith Paper China were Hua Tai, Gold East, Sun Paper, Nine Dragons, Lee & Man, Hong Ta and Gold Huasheng.

For these seminars Voith Paper China had put together a first-class team of its own specialists, supported by experts from Voith Technology Centers worldwide.

The seminar was led by Ming Ming Lou, President Voith Paper China. She began by introducing Voith Paper as a supplier and partner covering the entire papermaking process from stock preparation and sheet formation to finishing and slitter-winding. Voith Paper also supplies the entire web transfer system and components such as rolls and fabrics, she explained, as well as the complete automation. This enables single-source delivery of complete "Process Line Package" (PLP) production lines comprising optimally matched modules and components. To further consolidate Voith Paper's reputation for innovation leadership, 70 million Euros had been invested in the new Paper Technology Center at Voith headquarters in Heidenheim. President Ming Ming Lou pointed out how Chinese customers can also benefit from this R&D center by having trials carried out there under realistic conditions.

Life Cycle Partnership, the theme of these seminars, is an all-embracing approach covering technical service for paper production lines right through their operating life time. This also includes technical consulting, rebuild concepts, spare parts supplies, ongoing process optimization and comprehensive after sales service (AMB products). "We offer all-inclusive service and support for the entire production line right through its operating life", explained Ming Ming Lou, "and that is why we aim for life-cycle partnership with our customers".

And as a new development: in future the Voith Paper China headquarters will be in Kunshan, just outside Shanghai. Among other departments located here will be sales and marketing, development and engineering, spare parts logistics, project management, and automation. Voith Paper Fabrics and Rolls Service division plants were already established in Kunshan some years ago. Voith Paper China also has state-of-the-art manufacturing facilities and service centers in the Chang Jiang Delta and Round-Bohai regions, where a large part of China's paper industry is concentrated.

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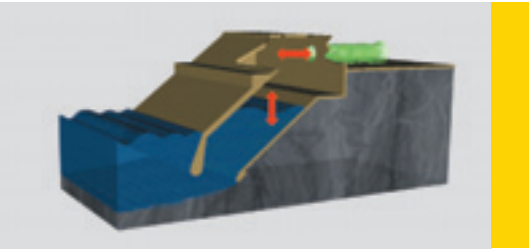
Energy from active breakwaters

Wave power is one of the largest global energy resources, but is also one of the most difficult to harness. Wavegen, a wholly owned subsidiary of Voith Siemens Hydro Power Generation, started tapping wave power at the westernmost point of Islay in the Hebrides.

This system utilizes wave power indirectly through the oscillations inside an onshore chamber connected underwater to the sea. When the water level in this chamber rises with an incoming wave, the air column above is forced out through a turbine, and when the level falls again, air is sucked in through the turbine (see diagram). In other words, the system "breathes" through the turbine in rhythm with the waves. But although the airflow direction keeps changing, the turbine always drives the generator in the same direction – thanks to the ingenious turbine blading concept.



The oscillating water column pushes and sucks air through a Wells turbine.

As nearly always, this concept was derived from Mother Nature. Apparently the inventor Alan Wells was inspired by the way the birds' up and down wing strokes propel them in only one direction. So his Wells turbine does exactly the same thing the other way round: the turbine rotates in the same direction whichever way the air flows through it.

According to Voith Siemens Hydro estimates, global wave energy utilization potential amounts to at least 100 GW. As a next step, Voith Siemens Hydro plans to install this innovative technology in existing or new port facilities and breakwaters, etc. to make the most of synergies: construction costs can be shared between the power plant and port facility operators. In nearly all cases commissioning and maintenance work can be carried out entirely on shore without incurring any costs for special marine infrastructures or vessels. Furthermore, grid connections from this onshore system are far easier and much less expensive. And very importantly: the Wavegen system has no impact on coastal environments.

Based on operating experience gained in the Hebrides, the first Wavegen plant is now planned in Germany as a joint venture between Lower Saxony Land and the EnBW power utility. Here again, the rated output will be 250 kW. A much larger Wavegen project with 3.5 MW rated output is currently under study for the Hebrides island of Lewis. This would supply enough renewable energy for about 2000 households.

Photo: Stora Enso Baienfurt

Voith Industrial Services implements OPM

Operator Maintenance at Stora Enso, Baienfurt

OPM is an innovative maintenance concept to ensure optimal plant availability. It covers not only maintenance, but also inspection and troubleshooting.
This concept enables the operator to take over certain maintenance, inspection and troubleshooting activities, thereby improving working methods, reducing repair costs and increasing machine efficiency.
For OPM implementation, the Voith Industrial Services team divided the project into three phases over a one-year time span. A special training program was developed to prepare the Stora Enso production and logistics people for their new tasks.
The OPM activities will be analyzed in working groups and divided thereby into maintenance task packages with a view to activity planning by SAP in future. The goal of this OPM project is to create an innovative and modern working concept for the paper industry that will set benchmarks in the Stora Enso Group, when fully implemented.

Voith Water Tractors will soon escort the biggest cargo vessels into the world's largest container port

Shanghai Deepwater Port, currently under construction, will be the world's biggest container port when completed.

The location of Shanghai's new deepwater port – 32 kilometers off the coast – reflects the enormous dimensions of this infrastructure project. With a mean depth of 15 meters, Shanghai Deepwater Port will accommodate the largest container vessels. As of October 2007 Voith Water Tractors (VWT) will assist them in safely entering the harbor and tying up at their terminals.

For these two new VWT, built at San Lin Shipyard, Voith Turbo Schneider Propulsion is supplying four Voith Schneider Propellers size 28 (28 R5/210-2), four Voith 1330 DTL fluid couplings, and two control stands. Crew instruction will be taken over by a Voith training captain, and the Chinese shipbuilder will also benefit from Voith Turbo Schneider Propulsion design and construction know-how – after all, these 30 m long and 11.2 m wide VWT are custom-made for the new deepwater port. Powered by two 1,940 kW Yanmar diesel engines, their rated speed is 12.5 knots (about 22 km/h). They are also equipped with state-of-the-art firefighting systems. These two Voith Water Tractors will be equipped with the four Voith Schneider Propellers for decisive reasons: their safety and reliability, manoeuvrability and precision in tug and escort duty as well as for firefighting.

In October 2007 both Voith Water Tractors will go into service after completion in only one year. By then some of the 50 container terminals will be ready, and it is already clear that several more Voith Water Tractors will be required by the time Shanghai Deepwater Port is completed.

More than 800 Voith Water Tractors are currently in service at over 120 ports worldwide. The long-standing success of this concept is proved by the Alaskan Environmental Ministry's classification as "Best Available Technology" (BAT).

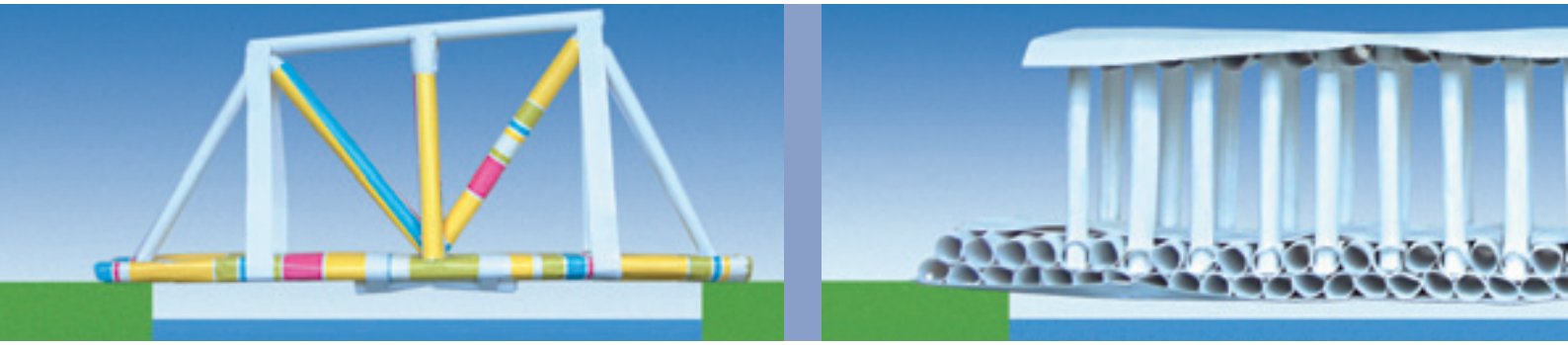
Paper bridge supports Chinese clay soldier

It sounds improbable at first, bearing in mind that a clay soldier of this sort weighs around 300 kg (661 lbs). At the 6th paper bridge competition held in 1999 in Mecklenburg-Western Pomerania, Germany, it was however proved that such a load could be borne, by a 40 cm (15.75 inches) span, by a paper bridge. Every year since, students from elementary school to college have been striving to beat this record.

The Mecklenburg-Western Pomerania paper bridge competition has been held at the Institute of Industrial Engineering at Rostock University for 13 years now. The aim is to build as strong a bridge as possible with a clear span of 40 cm (15.75 inches) using a maximum of 150 g (5.3 oz) of standard Bristol board and glue (UHU, Pritt, etc). The amount of paper permitted is roughly equal to 30 sheets of normal printing paper (80 g/m^2). The competition features two categories: 'elementary/high school students' and 'college students/staff'. The bridges' load capacities are determined using a testing machine. A single load is placed on the center of each bridge. The aim of the paper bridge competition is to get students from elementary/high school to college thinking both creatively and technically.

The hordes of participants, especially in the elementary/high school students category, span all ages. The youngest are aged around nine and the oldest 17 to 18. The competition is especially popular with those around the age of 12/13, because they have the chance to try out their

The most stable paper bridge to date bore 304 kg, which is equal to the weight of a Chinese clay soldier.



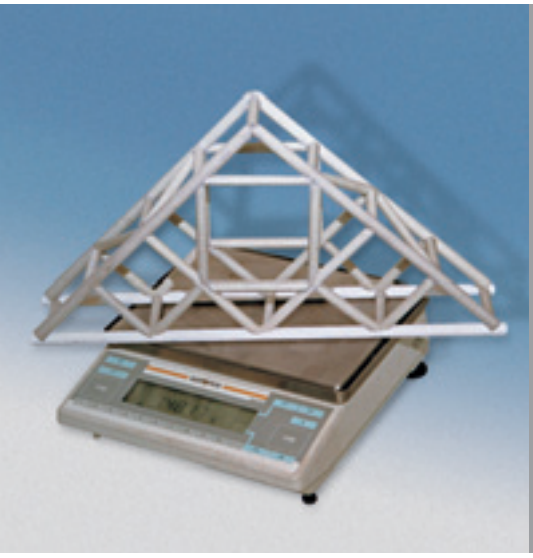
Different paper constructions.

designs in physics lessons and put their bridges to the test in a real competition. But also among college students, interest has been expressed by mechanical engineers, civil engineers and even a group of female economists who won the competition in 2004.

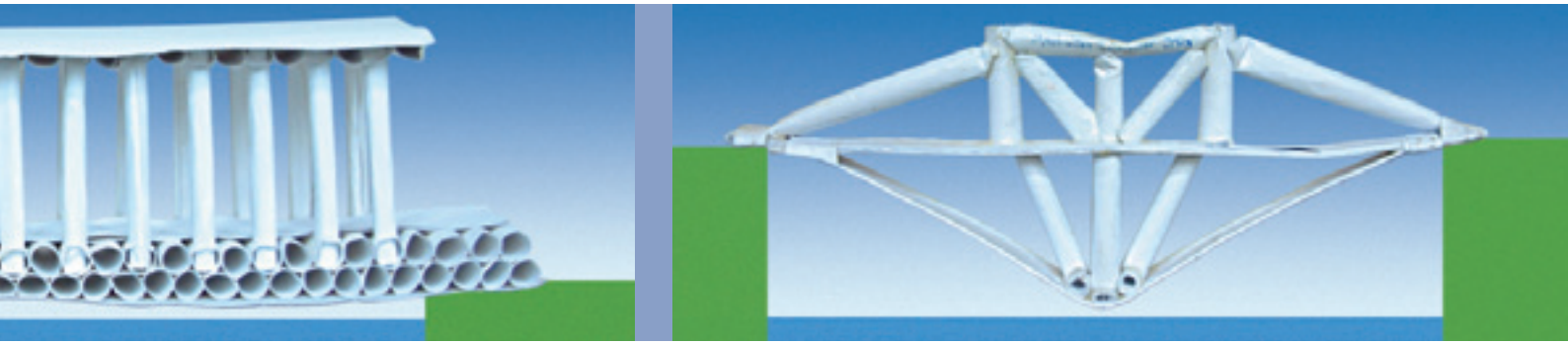
If you were to hold the specified quantity of paper in your hands, you would ask yourself how on earth this could support a Chinese clay soldier. This is where the creative thinking comes in: the idea is to find the best way of bringing out the paper's constructional properties using the laws of physics. If you look at a piece of paper, it's fairly obvious that based on its geometry, it's not suitable for absorbing compressive forces. Were the paper to be rolled into a tube, however, it would be able to withstand a fair amount, and halving the length of the tube with the same amount of paper doubles this load capacity. If, on the other hand, you wanted to tear the same sheet of paper by applying a pulling force at the ends, you would need a considerable force. It is through the combination of these two properties that the strongest bridge is made. This means that the areas, which are subjected to high pressure should have solid paper tubes beneath them, for example, while strips of paper are sufficient for areas subjected to pulling forces.
It is also worth noting that long, thin sticks kink very easily (see kebab stick), whereas shorter sticks are much more stable (such as matches).

When choosing the optimum structure, it is worth looking back to the really early days of bridge building. This may not seem particularly logical, since the first big bridges were all arched stone bridges, but even these needed adapting to constructional properties. The stones used could indeed cope well with compressive forces, but they were also very susceptible to pulling forces. An arched structure is ideal when using this type of material, because when the load is central, only compressive forces are applied. If you are to adapt this principle to a paper bridge, the arch must be reproduced using short, tightly rolled tubes stuck together at the ends. Since this type of construction is not one single, constant arch, compressive forces will be directed to the joints, causing the structure to buckle. This is where the paper's good resistance to tension comes into its own, using straps at the points where the paper tubes meet to pre-

Checking the overall weight.



Testing the load capacities.



vent buckling. Cleverly redirecting the pulling forces enables you to balance out the two halves of the bridge. The resultant bridge construction can also be seen as a 'truss construction'. This design is sometimes used for modern concrete and steel composite bridges too, whereby the concrete absorbs the compressive forces and the steel absorbs the tensions.

Of course, other bridge designs are also possible, such as the skeletal structure, which, as a design by high school students, demonstrated a high load capacity of 81.9 kg (180.5 lbs). Experience suggests, however, that the largest load capacities are achieved using an arch truss construction, or at least they have been so far. The maximum load capacity of this type of bridge, with a 40 cm span and no more than 150 g (5.3 oz) of paper, is currently 304 kg (670 lbs). In 1998, a similar bridge earned itself a place in the Guinness Book of Records for its 237 kg (522.5 lbs) load capacity. It's worth noting that the person who built this bridge not only followed a logical thought process, but also carried out a whole range of preliminary investigations. He studied the paper's tension resistance and perfected the load-bearing structure of his bridge using a computer program. Despite these considerable efforts, however, a number of competition entries were needed before getting the load capacity of his bridge design over 237 kg to the record level of 304 kg (670 lbs). This was in part due to the impact the joints had on load capacity, which could only be accurately determined when put to the test. It was also because the strength values of the paper and the joints were hard to pin down and subject to certain random variables.

Each year though, the results of the high school student's competition prove that high load capacities can be achieved without sophisticated analyses. This year's school bridge was carrying a good 118 kg (260 lbs) when it went down with a loud crash. The record in this category currently stands at 198.1 kg (436.7 lbs), under the same conditions as previously described.

So as to keep the Olympic ideal alive within the competition, there is a prize each year not only for the strongest bridge, but also for the prettiest, normally going to someone from a high school. With this prize it's all about the multitude of tiny details. When it comes to paper bridges, however, strength and beauty are not mutually exclusive, as shown by the skeletal bridge mentioned above. Not only was it a realistic replica of existing steel framework bridges; it also achieved a respectable load capacity of 81.9 kg (180.5 lbs).

The organisers are eagerly anticipating the competitions to come, which are sure to produce yet more innovative and impressive bridge constructions and designs.

Dr Olaf Mertzsch
Rostock University
Area of expertise:
solid constructions

Entry in the Guinness Book of Records.



Startup highlights 2005/2006

Fiber Systems

Stock preparation systems and sub-systems for graphic papers

Bowater Newsprint, Calhoun, TN, USA.
Weyerhaeuser, Hawesville, USA.
International Paper, Eastover, USA.
Bowater Canadian Forest, Dolbeau-Mistassini, Canada.
INPACEL, Arapoti, Brazil.
Guangzhou Paper, Guangzhou, China.
Shandong Huatai Paper, Dongying, China.
Sappi Ehingen, Ehingen, Germany.
Holmen Paper, Madrid, Spain.
Metsä Tissue, Katrinefors Mill, Sweden.
Papierfabrik Hermes, Düsseldorf, Germany.
UPM Nordland Papier, Dörpen, Germany.
Australian Paper, Burnie, Australia.
Arkhangelsk Pulp and Paper Mill, Novodvinsk, Russia.
Voith Paper Technology Center, Heidenheim, Germany.
Norske Skog Parenco, Renkum, Netherlands.
Mondi Paper, Durban, South Africa.

Stock preparation systems and sub-systems for board and packaging papers

Greif, Riverville, USA.
Republic, Lawton, USA.
CMPC Procor, Puente Alto, Chile.
ORSA, Nova Campinas, Brazil.
CMPC, Valdivia, Chile.
OAO Kiev Cardboard and Paper Mill, Obukhov, Ukraine.

Stock preparation systems and sub-systems for tissue papers

SCA South Glens Falls, USA.
Papeles Higienicos de Mexico, Col. Cuauhtemoc, Mexico.
Georgia-Pacific, Rincon, USA.
Georgia-Pacific, Muskogee, USA.
Fabrica de Papel San Francisco, Mexicali, Mexico.
Wausau Paper, Rhinelander, USA.
Coastal Paper, Wiggins, USA.
Kimberly-Clark de Mexico, Ecatapec de Morelos, Mexico.
PSA, São Leopoldo, Brazil.
CMPC Tissue, Talagante, Chile.

Paper Machines

Graphic papers

Shandong Huatai Paper, Dongying, China.
Voith Paper Technology Center, Heidenheim, Germany.

Board and packaging papers

Atlantic Packaging Products, Union, Scarborough Mill, Canada.
Saica, El Burgo de Ebro, Spain.
Zhuhai Hongta Renheng Paper, Zhuhai, China.

Tissue

CMPC, Talagante, Chile.
Shandong Hengan Paper Products, Weifang, China.
Hengan Paper, Jinjiang, China.
Productos Familia, Cajicá, Columbia.

Dewatering machines

Veracel, Eunápolis, Brazil.

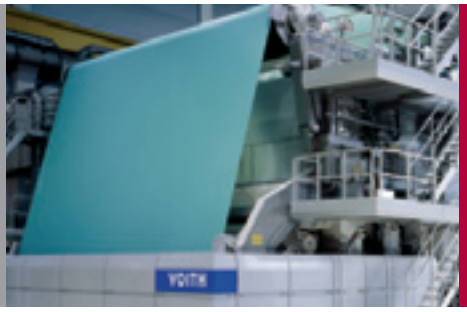
Installation and rebuilds

Goricane Tovarna Papirja Medvode, Medvode, Slovenia.
Dunafin, Dunaujvaros, Hungary.
Sappi Ehingen, Ehingen, Germany.
OAO Nemanski Cellulosno-Bumashni Savod, Neman, Russia.
UPM Papeteries de Docelles, Docelles, France.
Dresden Papier, Heidenau, Germany.
Mondi Business Paper, Ruzomberok, Slovakia.
Moorim Paper, Jinju, Korea.
Mondi Business Paper, Szolnok, Hungary.
Bowater, Calhoun, USA.
JSC Solikamsk Bumprom, Solikamsk, Russia.
Pan Asia Paper, Jenjou, Korea.
Norske Skog Tasman, Kawerau, New Sealand.
Norske Skog, Albury, Australia.
CMPC, Valdivia, Chile.
Celulose Nipo Brasileira, Cenibra, Belo Oriente, Brazil.
Aracruz Celulose, Guaíba, Brazil.
International Paper, Eastover, USA.
Visy Pulp and Paper PTY, Tumut, Australia.
Orsa Celulose, Papel e Embalagens, Nova Campina, Brazil.
Klabin, Angatuba, Brazil.

Coating technology

Norske Skog, Walsum, Germany.
Delfortgroup, Dunaujvaros, Hungary.
Mitsubishi HiTec Paper, Bielefeld, Germany.
Mondi Business Paper, Szolnok, Germany.
Mondi Business Paper, Merebank, South Africa.





Papel Aralar, Aralar, Spain.
Perlen Papier, Perlen, Switzerland.
Burgo Marchi, Villorba, Italy.
Burgo Marchi, Verzuolo, Italy.
Bowater, Calhoun, USA.
ShinMooRim Paper, Jinju, Korea.
VPK Packaging Group, Oudegem, Belgium.

Winding technology

Shandong Huatai Paper, Dongying, China.
Sappi Ehingen, Ehingen, Germany.
MD Papier, Plattling, Germany.
SCA Graphic Paper, Laakirchen, Austria.
Koehler Kehl, Kehl, Germany.

Finishing

Janus Concept

Perlen Papier, Perlen, Switzerland.
Papel Aralar, Amezketa (Guipúzcoa), Spain.

Ecosoft calender

Zhangqiu Huashi Paper, Zhangqiu, China.
Zhejiang Xianhe Special Paper, Quzhou, Zhejiang, China.
Sappi Ehingen, Ehingen, Germany.
Vipap Videm Krsko, Krsko, Slovenia.
Holmen Paper, Madrid, Spain.
Shandong Huatai Paper PM 11 (2) Dongying, China.
Weyerhaeuser Pulp & Paperboard Division, Longview, USA.
Mudanjiang Hengfeng Paper, Mudanjiang, China.
3M Canada, Brockville, Canada.
Trois Rivieres Centre Intégré en Pates et Papiers, Trois Rivieres, Canada.

NipcoFlex calender

Laborkalander, Krefeld, Germany.
Koehler Kehl, Kehl, Germany.
Weyerhaeuser Pulp & Paperboard Division, Longview, USA.

Calenders

Norske Skog, Albury, Australia.
Klabin, Angatuba, Brazil.
Hangzhou Tongda Paper, Fuyang, China.

Roll cutting machines

Cartiere del Garda, Riva del Garda, Italy.
Cartiere Burgo, Duino, Italy.
Oji Paper, Fuji, Japan.
Shandong Huatai Paper (2), Dongying, China.
UPM-Kymmene Papier, Schongau, Germany.
Stora Enso Kabel, Kabel, Germany.
Sappi Ehingen, Ehingen, Germany.

Parent reel cart

Sappi Ehingen (2), Ehingen, Germany.
Shandong Huatai Paper, Dongying, China.

Twister/Roll Handling

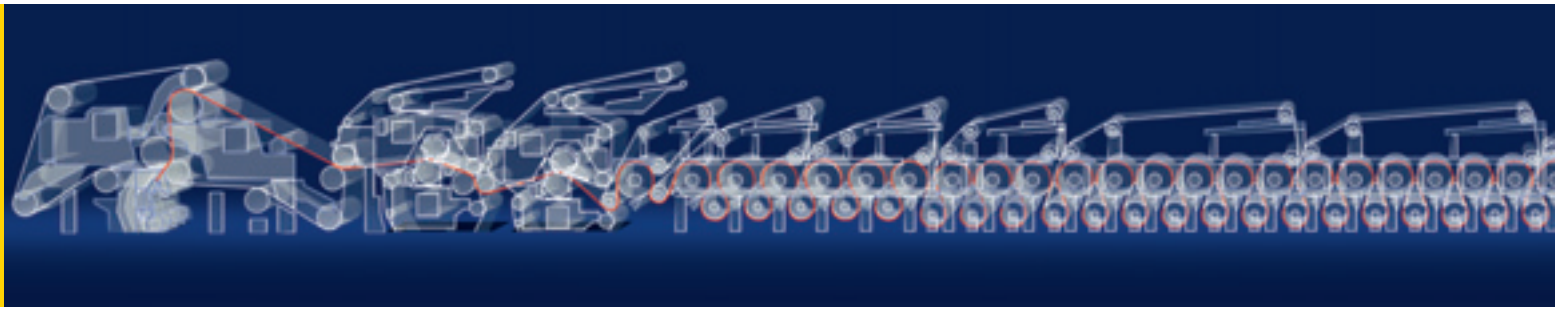
Roto Smeets, Deventer, Netherlands.
Shandong Huatai Paper, Dongying, China.

Automation

Sappi Alfeld, Alfeld, Germany.
UPM Nordland Papier, Dörpen, Germany.
Norske Skog Walsum, Walsum, Germany.
Stora Enso Kabel, Kabel, Germany.
Munksjö Paper, Unterkochen, Germany.
Stora Enso Baienfurt, Baienfurt, Germany.
UPM Papeteries de Docelles, Docelles, France.
Bowater Canadian Forest Products, Donnacona, Canada.
Steinbeis Temming Papier, Glückstadt, Germany.
Shandong Huatai Paper, Dongying, China.
Mondi Business Paper, Merebank, South Africa.
North-West Timber, Neman, Russia.
Holmen Paper Madrid, Madrid, Spain.
Saica, Zaragoza, Spain.
Cartiere Marchi, Toscolano, Italy.

Voith Fabrics

Nine Dragons PM 16, 17, China.
Lee&Man, China.
Zhangjiagang Huaxing PM 1, 2, China.
Sea Dragon, China.
YFY Yangzhou PM 1, 2, China.
Mudanjiang Hengfeng, China.
Guangzhou Paper, China.
Gold Huasheng, China.
Sun Paper, China.
PT Fajar Surya Wisesa, Indonesia.
Hiang Seng Fibre, Thailand.



Recent large orders

Fiber Systems

Stock preparation systems and sub-systems for graphic papers

International Paper, Cantonment, USA.
Bowater Canadian Forest, Dolbeau-Mistassini, Canada.
Abitibi-Consolidated, Mackenzie, Canada.
Propal, Cali, Columbia.
Daio Paper, Mishima, Japan.
Thai Paper, Khon Kaen, Thailand.
Stora Enso Publication Paper, Hyltebruk, Sweden.
Emami Paper Mills, Kolkata, India.
Sappi Ehingen, Ehingen, Germany.
Rama Newsprint and Papers, Surat, India.
EN Paper Jinju Mill, Jinju-City Kyungnam, Korea.
JSC Solikamsk Bumprom, Solikamsk, Russia.
Nampak Paper, Kliprivier, South Africa.

Stock preparation systems and sub-systems for board and packaging papers

Republic Paperboard, Lawton, USA.
International Paper, Mansfield, USA.
Klabin, Monte Alegre, Brazil.
São Carlos, São Carlos, Brazil.
PCE, Manaus, Brazil.
ZAO Proletariy, Surazh, Russia.
St. Regis Paper, Kemsley, Great Britain.
Cartiere Villa Lagarina, Villa Lagarina, Italy.
Delkeskamp Verpackungswerke, Nortrup, Germany.
OAO Kiev Cardboard and Paper Mill, Obukhov, Ukraine.
Papierfabrik Adolf Jass, Fulda, Germany.
Feinpappenwerk Gebr. Schuster, Hebertshausen, Germany.

Stock preparation systems and sub-systems for tissue papers

SCA Tissue, Alsip, USA.
SCA Tissue, South Glens Falls, USA.
Wausau Paper, Rhinelander, USA.
Coastal Paper, Wiggins, USA.
CMPC Tissue, Talagante, Chile.
SCA Hygiene Products, Mainz-Kostheim, Germany.
Metsä Tissue, Katrinefors Mill, Sweden.

Stock preparation systems and sub-systems for dewatering machines

Riau Andalan, Kerinci, Indonesia.
Fox River, DePere, USA.

Paper Machines

Graphic papers

Century Pulp & Paper, Lalkua, India.
Johns Manville, Etowah, USA.
Sun Paper Shandong, Yanzhou, China.
Phoenix Pulp & Paper, Khon Kaen, Thailand.
Daio Paper, Mishima, Japan.
Packages, Kasur, Pakistan.

Board and packaging papers

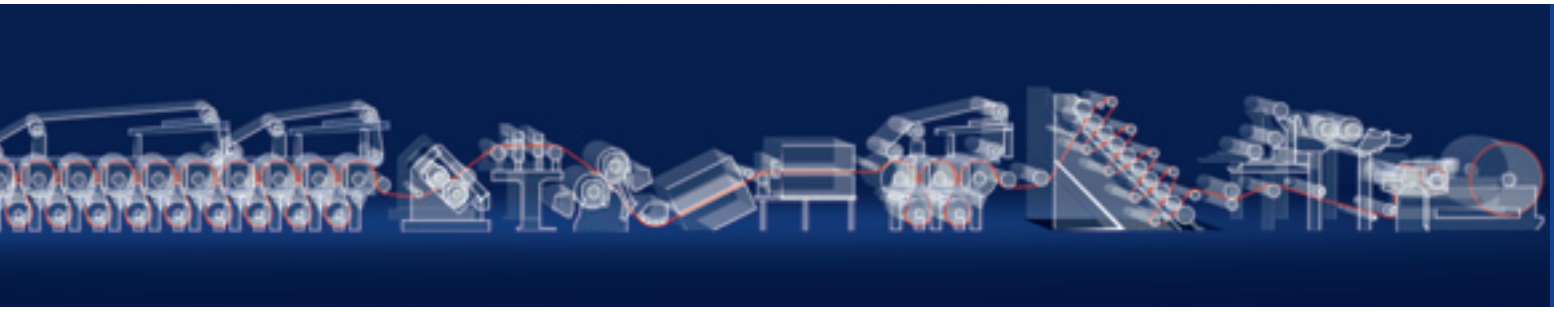
Klabin Monte Allegre, Telemaco Borba, Paraná, Brazil.

Dewatering machines

Riau Andanlan, Indonesia.
CMPC Celulosa, Santa Fé, Nacimiento, Chile.

Installation and rebuilds

Kimberly-Clark, Corinth, USA.
Mauduit Tobacco Paper, Jiangmen, China.
Packages, Kasur, Pakistan.
Oji Paper, Tomioka, Japan.
Hokuetsu, Niigata, Japan.
Coastal Papers, Rajahmundry, India.
Munksjö Paper, Unterkochen, Germany.
Shinho Paper, Daejeon, Korea.
Genting Sanyen, Selangor, Malaysia.
UPM-Kymmene, Tervasaari, Finland.
Daeyang Paper, Ansan, Korea.
Lecta Condat, Condat, France.
Neenah Paper Lahnstein, Lahnstein, Germany.
Nippon Paper, Ishinomaki, Japan.
Shandong Huatai Paper, Dongying, China.
Jinju, Jinju, Korea.
Holmen Paper, Braviken, Sweden.
JSC Solikamsk Bumprom, Solikamsk, Russia.
Nippon Paper, Japan.
Sappi, Skowhegan, USA.
Papresa, Renteria, Spain.
CMPC Celulosa, Santa Fé, Nacimiento, Chile.
Productora de Papeles Propal, Cali, Colombia.
Trombini Embalagens, Curitiba, Brazil.
Inpa Ind. de Embalagens Santana, Pirapetinga, Brazil.
Amcor Cartonboard, Petrie, Australia.
Kimberly Clark, Mogi das Cruzes, Brazil.
Botnia, Rio Negro, Uruguay.
VPK Packaging Group, Oudegem, Belgium.
Pro-Gest, Villa Lagarina, Trient, Italy.
Ningbo Zhonghua Paper, Zhejiang, China.
Mondi Packaging, Springs, South Africa.
SCA Packaging, Aschaffenburg, Germany.



SCA Packaging, Witzenhausen, Germany.
Les Papeteries de Champagne, Nogent-sur-Seine, France.

Coating technology

Dongguan Sea Dragon Paper, Dongguan, China.
Shandong Sun Paper, Yanzhou, China.
Klabin Monte Allegre, Telemaco Borba, Paraná, Brazil.
Torraspapel, Sant Joan Les Fonts, Spain.
Torraspapel, Leitza, Spain.
Mondi Packaging, Springs, South Africa.
APP, Ningbo, China.
Burgo Marchi, Villorba, Italy.
Phoenix, Khon Kaen, Thailand.
Daio Paper, Iyo-Mishima, Japan.
Packages, Kasur, Pakistan.

Winding technology

Nine Dragons Paper Industries, Jiangsu, China.
SCA Packaging, Aschaffenburg, Germany.
Klabin Monte Allegre, Telemaco Borba, Paraná, Brazil.
Thai Paper, Khon Kaen, Thailand.
Daio Paper Corporation, Mishima, Japan.
VPK Packaging Group, Oudegem, Belgium.
Soporcel, Figueira, Spain.

Finishing

Janus Concept

Boise Cascade, Wallula, USA.
Daio Paper, Mishima, Japan.
Stora Enso Huatai (Shandong) Paper, Dawang, China.

Ecosoft calender

Dongguan Sea Dragon Paper Industry, Dongguang, China.
Yanzhou Zhongtian Paper Industry, Yanzhou, China.
Thai Paper, Khon Kaen,Thailand.
Laborkalander, Krefeld, Germany.

NipcoFlex calender

Koehler Kehl, Kehl, Germany.

Calenders

Dongguan Sea Dragon Paper Industry, Dongguang, China.
Hansol Paper, Taejon, Korea.
Klabin Monte Allegre, Telemaco Borba, Paraná, Brazil.
Daio Paper, Mishima, Japan.
Wuxi Long Chen Paper, Wuxi Jiangsu, China.

Roll cutting machines

Koehler Kehl, Kehl, Germany.
Daio Paper (2), Mishima, Japan.
Klabin Monte Allegre, Telemaco Borba, Paraná, Brazil.
Stora Enso, Fors, Sweden.
Thai Paper, Khon Kaen,Thailand.
Hokuetsu Paper Mills (2), Niigata, Japan.
SCA Packaging, Aschaffenburg, Germany.

Parent reel cart

Daio Paper, Mishima, Japan.
Stora Enso, Fors, Sweden.
SCA Packaging, Aschaffenburg, Germany.

Twister/Roll Handling

Klabin Monte Allegre, Telemaco Borba, Paraná, Brazil.
Stora Enso, Fors, Sweden.

Automation

Norske Skog Walsum, Walsum, Germany.
UPM Schwedt, Schwedt, Germany.
Steinbeis Temming Papier, Glückstadt, Germany.
Sappi Alfeld, Alfeld, Germany.
Perlen Papier, Perlen, Switzerland.
Nine Dragons, Guangzhou, China.
JSC Solikamsk Bumprom, Solikamsk, Russia.
Holmen Paper, Braviken, Sweden.
Shandong Huatai Paper, Dongying, China.
SCA Packaging, Aschaffenburg, Germany.
Dongguan Sea Dragon Paper, Dongguan, China.
Mondi Packaging, Springs, South Africa.
Klabin Monte Allegre, Telemaco Borba, Paraná, Brazil.
Chuetsu Pulp & Paper, Nohmachi Mill, Takaoka, Japan.
Sonoco, Hartsville, USA.
IP Pensacola, USA.
Oji Specialty Paper, Nakatsu, Japan.
Thai Paper, Banpong, Thailand.

Voith Fabrics

Chung Loong Shanghai, China.
Lee & Man PM 3, 4, 5, China.
Nine Dragons PM 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, China.
Shandong Asia SSYMB, China.
Guangxi Jindaxing, China.
PT Indah Kiat Pulp & Paper, Perawang Mill, Indonesia.
PT Aspex Kumbong, Indonesia.
St. Regis Kemsley Mill, Great Britain.
NewPage Escanaba, MI, USA.
Weyerhaeuser Dryden, Ontario, Canada.
Stora Enso Kimberly, WI, USA.
Boise Paper International Falls, MN, USA.
Stora Enso, Kvarnsveden, Sweden.
Holmen Paper, Braviken, Sweden.

Voith Paper

Newsmagazine for the international clientele, partners and friends of Voith Paper

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