In 1999 Gold East Paper in Dagang, China started up their PM 1 and PM 2 coated wood free grades lines supplied by Voith. Since then both paper machines, with a wire width of 10,400 mm, have continually increased speed and production records. Dagang is a green-field mill three hours’ drive from Shanghai on the Yangtze, China’s biggest river. The site was foresightedly dimensioned to allow enough space for additional paper production lines. In August 2003 the Zhenjiang Star Group in Yiangzu province decided to add another production line in Dagang, and Voith, as preferred supplier, received the order for PM 3, likewise operated by Gold East Paper.
This makes Dagang, in Yiangzu province, China’s biggest production plant for double-coated wood free grades. Gold East Paper now operates three production lines there with a total capacity exceeding two million tons annually.

The PM 1 and PM 2 machines delivered by Voith in 1999 each produce 500,000 t.p.a. of art paper, roll offset and copy paper (see twogether 8). The new Voith machine PM 3 that started up in mid-2005 is designed for producing similar or higher-quality grades at the impressive (100%-efficiency) rate of 1,100,000 t.p.a.

In view of China’s steeply rising paper consumption (at about 8% p.a.), Zhenjiang Star Group expanded production capacities in Dagang to meet demand accordingly. This also reflects China’s efforts to increasingly cover paper requirements from its own mills, at the same time catching up with the latest technology or even advancing to the front line.

Here is what Gold East Paper says: “China's paper market is enormous, so capacity expansions are indispensable. Dagang is the ideal location for this expansion project. There is still enough space there, and all the necessary infrastructures and logistics are in place. The Yangtze river provides plenty of process water, and there is no problem with additional energy supplies. Our new PM 3 gives us so much more production capacity that we can now meet the rising demand for coated wood free grades both in Asia and internationally.”

Raw materials supplies are assured by river transport on the Yangtze, with direct connection to the ocean. Fiber material, coating materials, chemicals and additives are either transshipped at the Gold East Paper dock in Dagang, or supplied from the company’s own warehouses.

| Max. parent roll diameter | 3,500 mm |
| Parent roll width         | 9,770 mm |
| Max. parent roll weight   | 130 t    |
| Production capacity PM 3  | 1,100,000 t/year |
| Wire width PM 3           | 10,600 mm |
The project – innovation plus investment security

Voith was entrusted by the Chinese client in August 2003 with full responsibility for this bold and innovative project. From pulp bale handling to finished paper rolls, Voith supplied all key components of the new PM 3 production line.

Another Gold East Paper comment: “Our new PM 3 meets a long-standing need. Voith is a highly competent and reputed supplier of papermaking lines and auxiliary equipment, and our cordial partnership with Voith in all areas of papermaking technology goes back many years. It has always been matter-of-course for us to develop new concepts and innovations together. That is one of the main reasons why Zhenjiang Star Group and we as plant operators chose Voith to supply this new production line.”

At the heart of this new facility is the online paper machine for double-coated wood free grades in the basis weight range of 70-128 g/m², based on the Voith “One Platform Concept”. Gold East Paper’s new PM 3 incorporates innovative trend-setting key components well-proven over the years on dozens of production lines worldwide. And the latest technologies are used here in order to meet the demanding requirements for dependable production and high profitability.

The project was executed according to Voith’s “Process Line Package” procedure. In other words, Voith as coordinating partner was responsible for the design, procurement and installation supervision of everything affecting the papermaking process. Voith was also responsible for meeting all deadlines and complying with the quality and production specifications – to the great relief of all concerned!

With a wire width of 10,600 mm PM 3 may not be the widest paper machine in the world, but experts have known for a long time that production output depends much more on throughput and overall line efficiency than on wire width. Its enormous capacity of 1,100,000 t.p.a. (at 100% efficiency) and design speed of 2,000 m/min make PM 3 the world’s highest-performance paper machine.

Compared with the PM 1 and PM 2 lines, this new one represents a quantum leap in production capacity and speed. Another development challenge was the online operation of PM 3 with integrated coating machinery (1 SpeedSizer and 2 JetFlow F coaters), as against PM 1 and PM 2 that still produce coated grades in an offline concept.

Stock preparation

Two complete fiber lines for bleached short fiber chemical pulp, each including bale handling and pulper charging system plus the well-proven TwinFlo double disc refiner technology – together with a complete line for bleached long fiber chemical pulp – ensure the necessary high finished stock quality is fed to the blending chest. Well-proven stock preparation process components are installed, including Voith VS pulpers and E series deflakers.

Peripheral cleaning, screening and processing stages prepare the stock to the required quality before it is diluted and pumped to the MasterJet headbox. The approach flow includes the two largest pressure screens ever supplied by Voith, each with a total screening area of 13 m².

Paper machine

The DuoFormer TQv has a MasterJet headbox with well-proven OnQ ModuleJet dilution water control. The forming unit generates a homogeneous sheet by perfect fines and filler distribution to improve formation with almost symmetrical drainage.

After sheet formation in the DuoFormer TQv, the wet web is taken off the bottom wire by the first pick-up roll and fed to the Tandem NipcoFlex press section without open draws ensures optimal runnability. Here the web is further dewatered and compacted. The shoe length plays a particularly important role in this connection by preventing crushing of the hard-to-de-water furnish.
Fig. 1: Gold East Paper PM 3 – overall length 352 m.

Fig. 2: Pulp bale handling.

Fig. 3: TwinFlo double disc refiner system.
In the TopDuoRun dryer section, fitted with a ropeless sheet transfer system, the web is dried to a residual moisture content of 4%. Voith Paper Automation supplied an EnviroScan for the first dryer group that enables online measurement of dryness values and moisture cross-profile directly after the press section – precisely the tool papermakers have always dreamed of!

To ensure consistently uniform coating in the SpeedSizer, the web is pre-calendered after the dryer section in an EcoCal calender with a FlexiTherm top roll (at 80 °C surface temperature) and a 52-zone NipCorect bottom roll. This guarantees an excellent CD profile, as required.

The SpeedSizer, optionally using sizing, coating or a single-sided combination of both and applies the precoat to the paper. The following infra-red and convective drying makes a targeted balance possible by influencing binder migration and penetration.

The web is then coated on-line in two Voith JetFlow F dynamic blade coaters. As a new development, the blade beams are entirely made of CFC (Carbon Fiber Compound), a world-wide first in this width. For the specialty grade calendar paper, conventional sizing is used on coater 1 instead of color, which is otherwise used only in film presses. The new dynamic coater has no problem with this.

The three TopDuoRun after-dryer sections following the SpeedSizer and blade coaters are of conventional design with open hoods.

For perfect coating results, optimal infra-red drying is required. After excellent results with the Krieger infra-red dryers already operating for years on paper machines 1 and 2, the customer again chose Krieger equipment. An integrated dryer was, therefore, installed after the SpeedSizer, and four more InfraAir drying systems after the two JetFlow coaters. They are all fitted with the Krieger InfraMatic.
Finishing

The finishing section includes a reel spool/parent roll handling system, two Janus MK 2 calenders, and two VariPlus winders.

The reel spool handling system includes 3 automatic parent reel carts and 3 magazines for parent rolls as well as 4 magazines for empty reels spools.

Included in the scope of supply are two very large 10-roll offline Janus MK 2 calenders. The 45° stack angle enables fast roll changing and easy access to all relevant component groups. Maximum operating speed is 1,500 m/min. Nipco rolls are used at top and bottom. The polymere rolls with Rubin G covers are flexible rolls and extremely resistant to marking and wear. Thanks to the patented NipProtect system, all rolls can be opened smoothly in considerably less than 0.5 seconds. Rapid parent roll changing is ensured by unwinding with flying splice. A Sensomat Plus ensures meticulously wound rolls. Apart from the normal 9-nip Janus operating mode, both machines can also run in single-nip mode; the paper is then calendared in the top and bottom nips. These Janus calenders give the paper surfaces optimal gloss and smoothness, resulting in excellent printability.

The two highly automated VariPlus winders cut the 10 m wide web into smaller system for perfect control of moisture cross-profile. The infra-red dryers on PM 3 represent an installed infra-red capacity of more than 15 MW in a very small space.

At the end of the paper machine the double-coated sheet is wound up on a well-proven Sirius reel into jumbo rolls weighing 130 tons each. Reel spool changes are done by Voith’s patented EcoChange W, an ingenious device with two traversing high-pressure water jets that slit the web at lightning speed before it is taken over by the new empty reel spool.

In order to minimize the risk of sheet breaks, above all during coating, this state-of-the-art paper machine is also fitted with a web inspection system.

Voith Paper Automation furthermore supplied cross-profile control systems along the machine, a complete bearing monitoring system, and the entire machine control engineering.
widths and wind them into rolls according to the size required by the consumer. For the grades produced in Dagang, the VariPlus is the ideal machine: the roll sets are supported on the center drum in the 3 o’clock and 9 o’clock positions respectively, thus enabling the particularly sensitive line force control required for delicate paper surfaces. This positive effect is reinforced by a patented MultiDrive cover on the center drum that greatly reduces the line force acting on the roll set. Even with 6-ton paper rolls wound at 2,500 m/min, the VariPlus winders still run perfectly smoothly. The result is faultlessly wound paper rolls with optimal hardness. Since both winders are equipped with automated butt-splicing for unwinding, there are no ungainly splices in the finished rolls and further processing by the consumer is all the more trouble-free.

The impressive dimensions of this paper machine are underlined by the following technical data:
- Production capacity 1,100,000 t.p.a.
- Design speed 2,000 m/min
- Wire width 10,600 mm
- Overall length from former to winders 352 m
- Total number of components manufactured 1,585,900
- Number of containers delivered 1,300
- Number of individual deliveries 9,200
- Total weight of all deliveries 37,600 tonnes.

Erection and commissioning – all targets reached on time

Projects of this magnitude cannot succeed without perfect teamwork between customer and supplier right from the start. Once again, Gold East Paper and Voith met this joint challenge very successfully. The results speak for themselves. After finalizing the machine concept together, the engineering work started. Since the start-up date had already been established, there was no time to waste, so Voith took over the basic and detailed engineering for the entire production line.

All expectations were fulfilled, and the all-important engineering documentation was handed over in good time.

As before with PM 1 and PM 2, the customer took over all erection work. Gold East Paper installed tens of thousands of machinery and plant components fault-
lessly under Voith supervision – a fantastic achievement.

Meanwhile the well-planned training program was started. For twelve weeks the customer’s personnel learnt all the necessary theoretical knowledge, backed up with tours of the plant in course of erection. This was followed up by practical training directly on the machine, including the commissioning and start-up phase.

The operating checks also began on time, and only a few days after the first paper on wire, the Sirius reel was already winding up at full web width. As a result, the start-up deadline was beaten by a full week.

Furthermore, all fabrics were supplied by Voith Paper Fabrics and showed excellent results throughout the paper machine – well-coordinated single-source deliveries certainly pay off!

The results – first class paper in record time

After more than meeting the start-up deadline, the next step was to optimize the product quality. Gold East Paper and Voith scored a bulls-eye in numerous respects with the PM 3 project. After fulfilling all the product quality guarantees only six weeks after startup, operation test acceptance already took place in mid-December 2005. The paper grades produced on this machine are destined not only for the Chinese market, but also for export.

The production speed increases were likewise reached earlier than planned. Currently the machine is producing first-class art paper at a steady speed of 1,500 m/min, and roll offset printing grade production is in the test phase.

Further quality optimization and efficiency enhancement measures are proceeding intensively, so that steady operation at 1,800 m/min should soon be reached.

All in all, Dagang PM 3 sets benchmarks not only in Voith Engineered Reliability, but also in Gold East Paper Innovation, Efficiency and Punctuality.

Voith scope of delivery

Complete production line comprising stock preparation, paper machine and finishing section as described above, including in detail:

- 4 bale dewiring and raw materials handling systems for feeding 3 virgin fiber pulpers
- Advanced Wet End Process (approach flow, broke preparation and fiber recovery)
- Process water systems including water treatment and cooling water
- Chemicals preparation and dosing technology
- Break pulpers and broke preparation
- All chests and tanks
- Vacuum systems
- Steam and condensate systems
- Air technology for the paper and coating machines
- Working stations for pre-coat and top-coat color
- Complete tail threading systems including belts and tail cutters
- Paper roll transport systems including parent reel carts and conveyors
- Central lubrication systems
- Compressed air plant
- All piping and valves
- PCS 7 control systems for the paper machine, Janus calenders and winders
- Web inspection system comprising 3 transmission and 2 reflection beams
- Voith Monitoring vibration analysis system for the complete production line
- All field instruments and control valves
- All PM clothing by Voith Paper Fabrics (VF forming wires, press felts and dryer fabrics)
- Re-reeler

Fig. 8: The OnV web inspection system plays a vital role.

Fig. 9: VariPlus winder.

Fig. 10: Schematic layout of PM 3.