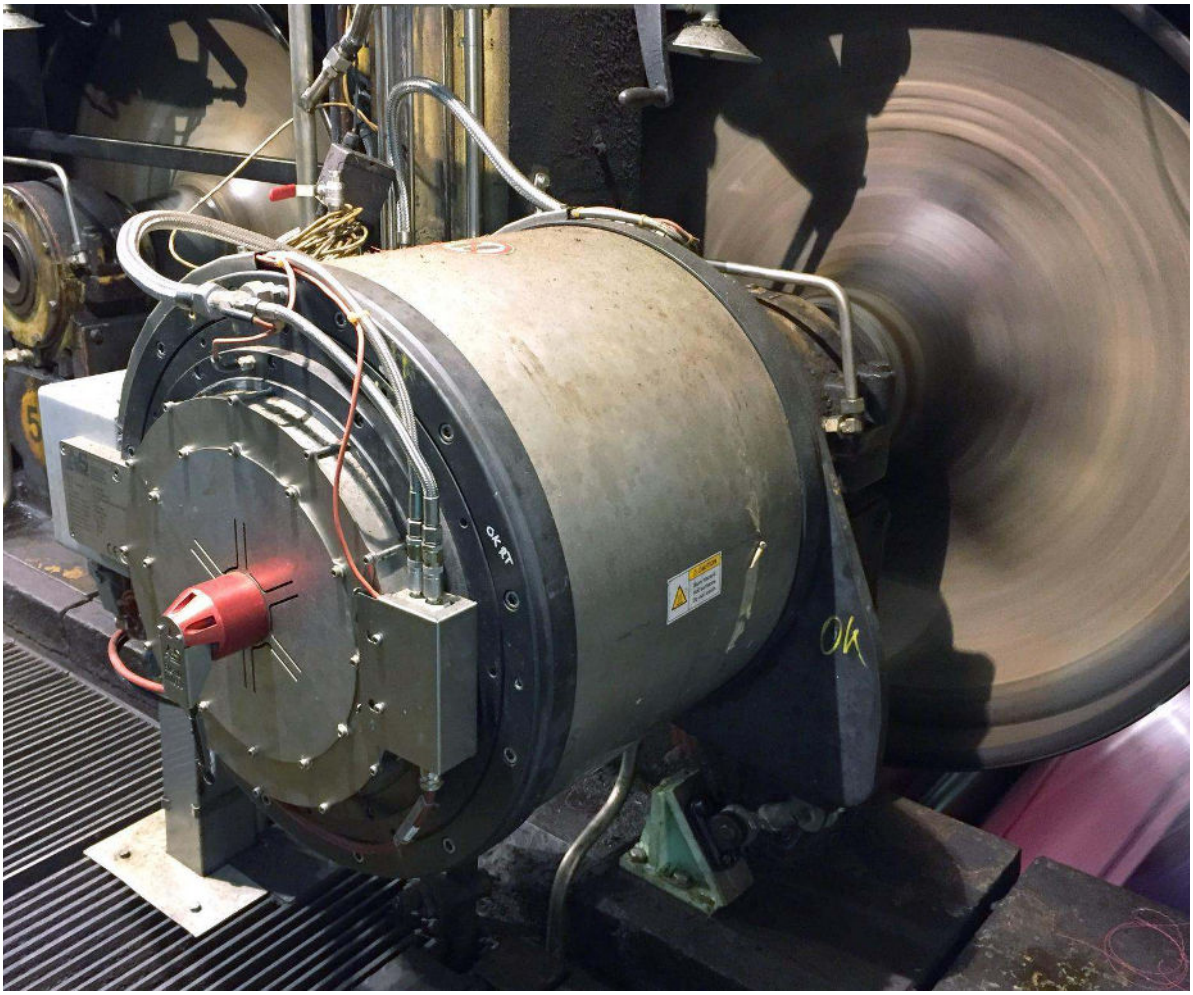

The FlexoDirect® is developed and produced in Germany at AS Drives.

Innovative direct drive

Mondi counts again on direct drive technology with FlexoDirect®

In October 2015 Mondi produced its craft paper in Štetí (Czech) for the first time by the help of the newly direct drive FlexoDirect®. Mondi Štetí belongs to the international Mondi Group and is one of the leading producer of sack paper and special craft paper. Within this turnkey project, AS Drives & Services GmbH (AS Drives) as general contractor and its cooperation partner Kühne+ Vogel Prozessautomatisierung Antriebstechnik GmbH (Kühne+Vogel) modernized the complete drive- and lubrication technology of the PM5.

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Scope of the project

One major goal of the rebuild of the PM5 at the Mondi mill in Štetí was, to eliminate the maintenance-intensive and prone wheel housing drive. Within the scope of the rebuild, the design speed for the drive was increased to 1 200 m/min.

AS Drives carried out the Engineering of the drive- and lubrication technology as well as the project- and installation management. Within this major project, almost all drive points from the wet end to the reel have been modernized. For the drive of the dryer group Mondi counted again on the high efficient direct drive technology from AS Drives. The complete **FlexoDirect®** is developed and produced in Germany at AS Drives. Since 2010, this drive has proved itself in different paper machines. Altogether 26 hollow shaft direct drives have been delivered for this project for the drive of the dryer groups *(Fig. 1).*

Next to eleven standard drives, AS Drives delivered two fully automated cooling-aggregates **Cooliflex®** as well as 26 intelligent flow controller **FlexoFlow® Water**. With the Cooliflex® and the FlexoFlow Water®, an optimal temperature-management of the drives, even within the dryer group, is given at all times.

Fig. 1: Direct drive FlexoDirect®

The company Kühne + Vogel was responsible for the renewal of the drive- control technique of the new multi-engine-drive, and delivered the complete part of the power electronics.
Next to the drive technology, AS Drives modernized the lubrication technology in the complete dryer section of the PM 5. Through the redesign of the framing-parts, it could completely dispense of oil within the gearbox.

The old dryer group drive before the modernization

Before the rebuild at Mondi Štetí, the dryer groups of the PM5 were driven through a closed gearbox *(Fig. 2, 3)*. The necessity, to charge the mechanic coupling point with fresh oil, makes a gearbox in regard to leakages difficult to manage. These criteria speak against this form and are not up-to-date to the present drive technology.
AS Drives shows within this project, how an older gearbox drive can be modernized in an economical and a sustainable way. The housing of the gearbox stays as a carrying part of the machine frame. The expansion of gearwheels within the gearbox and the consequent elimination of the mechanical torque converter, increase the smooth running and the efficiency. The old drive motors including their pre gearboxes have been removed completely *(Fig. 4)*.
After the rebuild, only the roller bearings of the cylinder in the dryer group have to be supplied with fresh oil. The old gearbox drive was dried up.

Fig. 2: Conventional drive with electrical motor, pre gear and shaft, outside the dryer hood.

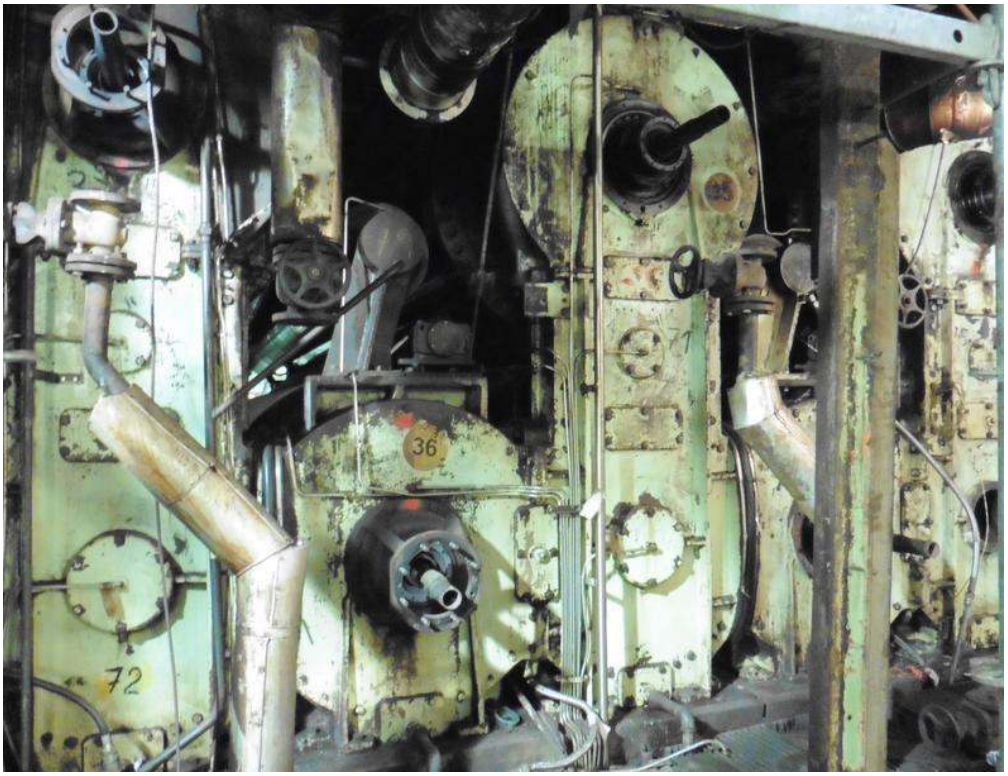

Fig. 3: Closed gearbox as drive of the dryer groups of the PM5, already without steam heads.

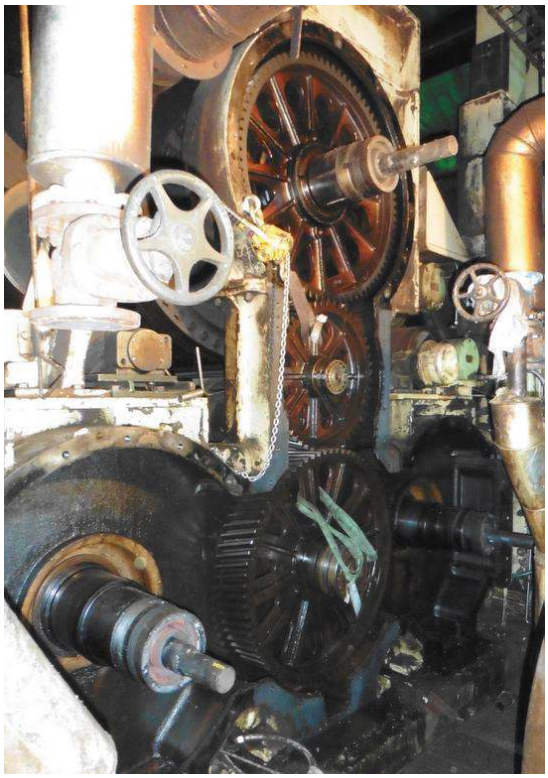

Fig. 4: Opened gearbox incl. gear pinions (partly already dismantled).

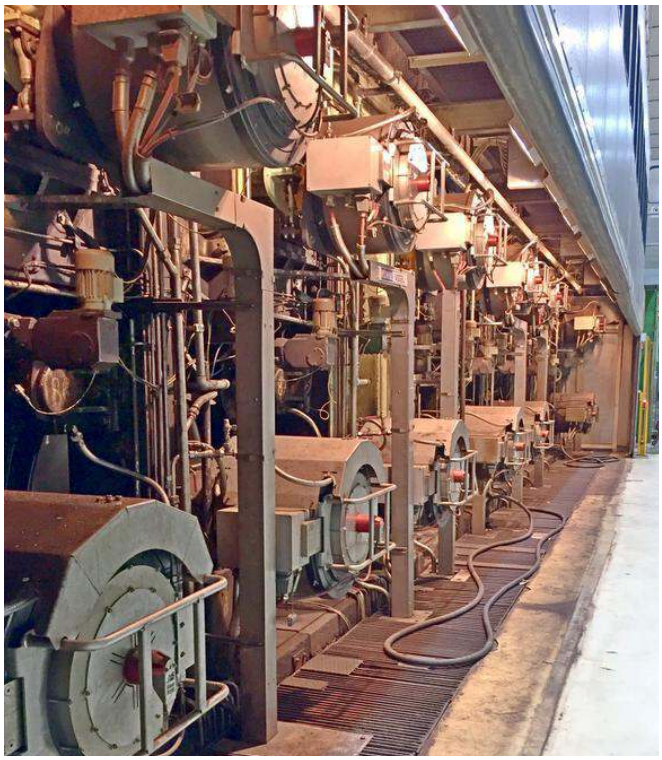

Fig. 5: Post dryer section of the PM5.

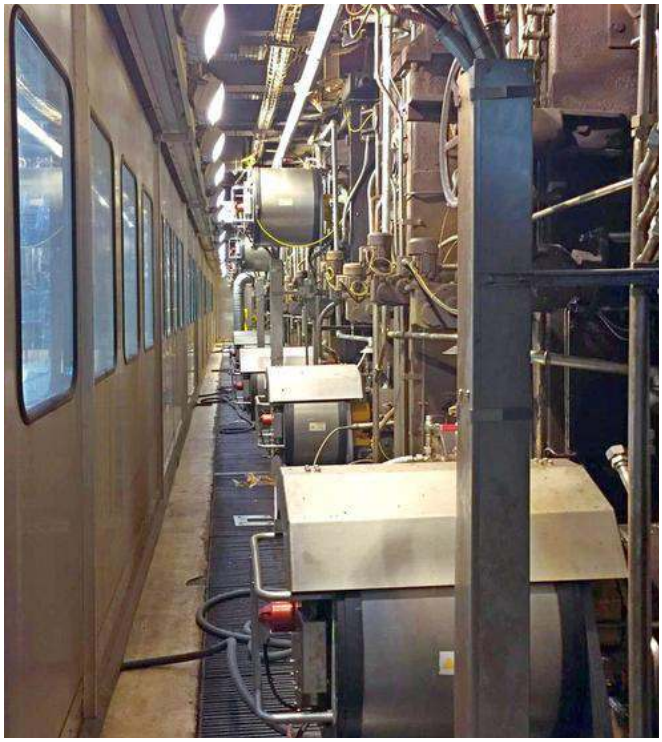

Fig. 6: View inside of the dryer hood.

The innovative direct drive for all dryer groups

In parallel with the dismantling of the old gearbox drive, the new drive system was installed.

During the Turnkey-Projekt at Mondi Štetí, the direct drive FlexoDirect® comes into operation for the drive of the dryer groups. This hollow shaft drive is installed directly to the cylinder journals. This setup drives the dryer cylinders nearly loss-free in a force-fitted, and torsion proofed way. In this process, the motor is carried from the journal – there is no additional base, console or frame needed. A torque support with ball joint head protects the machine against the existing frame.

Already in 2014, AS Drives and Kühne+Vogel realized a comparable drive project of the sister machine PM6 in the Mondi-mill in Dynäs (Sweden). The advantages of this compact drive technique and the good experiences with the project as well as the used technique initiated Mondi again, to come back to the motor-technology from AS Drives.

Both projects differ in the connection from the FlexoDirect® onto the dryer groups. So far, the FlexoDirect® was used only for the connection to the driving side: At the project in Štetí the customers wished to realize a tender-sided connection with this drives *(Fig. 5)*. Therefore, the existing cylinder journal on the tender side was grinded straight and was extended with an extracting link „suitable for casting". A mounting set was integrated axial into the inside of the cylinder, so that the torque can be passed force-fitted into the face of the journal. The support of the reaction torque was designed from the AS-Engineers, so that a good accessibility to the paper machine remains without tensioning of the drive.

The drive layout for the complete machine was layed-up by AS Drives under consideration of the specific characteristic of the felt guidance in the dryer section. The AS Drives Engineers managed, that only two different motor types are needed to equip the complete dryer groups, despite of the different layouts of the dryer groups. – that reduces the reserve holding and the variety of the components. Due to the fact that synchronous machines come to operation, high total efficiency factors can be achieved. The new drive contains 26 FlexoDirect®.

In spite of the high power of the FleoxoDirect®, this motor got a compact structural shape and fits, compared to conventional drive-soluti-

Fig. 7: Completed switchboard for the dryer group.

Fig. 8: WebDrive+/Paper drive technology on the OptiPress central press roll (2*880kW performance).

ons inside of the dryer hood *(Fig. 6)*. Due to that, the space requirements are reduced. With the installation of the FlexoDirect®, there is no breakthrough of the dryer hood necessary, which leads to better heat balance and leads to benefits regarding the hood design.

Because of the process-related higher temperature inside of the hood, the motor will be supplied with appr. 60–70°C warm water during operation. This water is provided by an external cooling-unit within a closed cooling water circuit.

Due to the precise control of the FlexoDirect®, the torsional rigid connection and the omission of mechanical components, Mondi Štetí got a smooth and dynamic drive, which meets all demands of the future. The omission of the intermediate shafts, gearboxes and wheels reduce the maintenance effort and the noise emission as well as the harmful vibrations inside of the dryer group.

The scope of the project electrical engineering

Beside the mechanical rebuild of the PM5 the drive- and control technology of the multi motor drive was renewed. Kühne+Vogel delivered the complete electrical part. In this context, all other drives for the felt, the press, Clupak and pope were changed and adapted to the higher machine speed. The machine received a complete new press section. The scope of Kühne+Vogel consists as a „turn-key-solution" the complete drive engineering, the layout of the drives, the project planning and the delivery of the switchboards *(Fig. 7)*. Furthermore Kühne + Vogel delivered new control panels, the electrical installation on site as well as the software development and commissioning of the multi motor drive, inclusive the integration into the existing process leading system.

A special challenge was the electrical installation of the FlexoDirect®-drives on the operating side. The crossing under the machine cellar as well as lengthwise wiring on the operating side needed a detailed planning in advance to consider the tight and inaccessible operating side, so that the procedure can be on schedule during the rebuild.

The integration of the FlexoDirect®- in the multi motor drive happened under use of the software library WebDrive+/Paper from Kühne+Vogel.

Fig. 9: New operation station for the wire- and press-section.

Fig. 10: Insertion of the switchboard with a truck-mounted-crane.

Installation-team of AS Drives & Services GmbH.

Fig. 11: Flow control FlexoFlow® and FlexoFlow® Water.

Due to the extreme high dynamic of the drives, special control procedures were implemented, which guarantee a safe and reliable operations in all operating states under consideration of the required preciseness. The single drive technic could show under this circumstances, that in the specific case of the dryer cylinder with different felt configuration a flawless sheet-run can be guaranteed without raised felt load or sheet flutter *(Fig. 8, 9, 10)*.

By the combination of the modern and gearless direct-drive technology in the dryer sections with gearbox drives in the wet section, Clupak and on the pope, a future orientated, economical and high-grade energy efficient drive solution based on the state of the art technology arised.

New lubrication technology

Within this rebuild project, AS modernized also the complete oil lubrication system for the dryer section. This consists of an obsolete lubrication unit and flow controller with simple monitoring function. A pass on of the status of condition resp. alert to the PLC was not possible with the old system.

The new oil lubrication system in the dryer section consists of a central lubrication unit Lubriflex® Type 5000 as well as 336 intelligent flow controller FlexoFlow®, allocated of 16 Terminals *(Fig. 11, 12)*. The lubrication unit Lubriflex® involves all parts which are necessary to provide the oil. Additionally a special degassing unit inside the tank of the Lubriflex® degasses the oil. After the oil treatment, the FlexoFlow® takes over the allocation of oil to the lube points. Additional operating states like crawling, start up as well as part load with different values can be programmed. The FlexoFlow® adjusts these values fully automatically on demand. Over flows of bearings due to cold oil will be avoided. Obviously, all data will be provided to the Process-Leading-System.

Fig. 12: Lubriflex® Type 5000.

An adjustment of the oil flow values is also possible on this way. AS Drives installed all components for the systems out of one hand. – this contains besides the piping works also the setup of the Lubriflex® as well as the commissioning of the complete system. Due to the optimal degassing features of the Lubriflex® and the fully automatically adjustment of the FlexoFlow®, Mondi Štetí received a reliable and environmentally conscious lubrication technology with many advantages.

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Comment of the project director Helmut Riesenberger, Mondi

Helmut Riesenberger (project director rebuild of the PM5, Mondi Štetí) remembers after one year operation of the new components and summarizes as follows: "In spite of many parallel works, like changing the dryer hood, new press section and foundation works we were good in time and the machine started up after all rebuild and modernization actions according to the schedule. Concerning the new drive and the new lubrication technology, all our expectations have been fulfilled completely. The control of the drive gave us enormous advantages in the production and with a regard to our quality standards. Furthermore, the problems with the oil leakages at the closed wheel housings are eliminated to 100 %. Thereby the maintenance effort was reduced drastically. The reduction of the vibration as well as the reduction of the noise level makes the new drive to a real "SilentDrive". All in all we are very happy with the rebuild."