Direct Drive System for the Pulp and Paper Industry

Innovative Drive Technology to Improve Overall Efficiency
ABB is the recognized leader in drive systems for the pulp and paper industry. ABB was a pioneer in digital sectional control solutions for the forest industry and the first to introduce fully digital AC drive systems.

With the introduction of the revolutionary Direct Drive technology, ABB again introduces a new exciting solution for the pulp and paper industry.

**A technology for the coming decades**

The constant development of ever faster and larger paper machines and more efficient processes places high demands on electrical drive systems. On the other hand, the new innovations improving those processes have often been enabled by the ever challenging development of drive technologies.

The Direct Drive System is ABB’s newest innovation to improve paper machine efficiency. It provides a foothold for entirely new mechanical configurations:

- No gearboxes
- No pulse encoders.
Reduced life cycle cost with Direct Drive.
The new technology allows new savings in several life cycle phases of the machinery.

Fewer components and simpler configurations reduce plant engineering hours, make installation easier, cut down supplier contacts, allow more efficient use of mill floor space and trim spare-part inventories.

The Direct Drive system has a considerable impact on operational savings. Simpler configurations bring an improved level of machine availability. Fewer production interruptions and ramp-ups decrease raw material waste, increase end product quality and reduce wear and tear on production machinery. Maintenance and repair work can also be carried out faster.

Wide range of applications
ABB’s drive installations include all types of papermaking machinery

- Pulp dryers
- Paper machines and tissue machines
- Coating machines
- Finishing machines of all types

The Direct Drive technology can be applied to all machines that traditionally include mechanical reducers for low speed rolls.

With recent increase of paper machine running speeds the required application motor speed for Direct Drive control is more than 300 rpm. This is the figure where the effective design speeds of Direct Drive begin.

Reduced total life cycle costs
- Better availability with fewer drive components
- Less maintenance
- Better paper machine runnability
- Reduced total acquisition costs
- More sidebay area
- Simpler building structure
- Less installed hardware and simpler installation
- Less environmental loading

Driven roll(s)

600 rpm

1500 rpm

Jackshaft

Reducer

Motor

 Encoder

315 mm

3500 mm/2500 kg

(typical section arrangement)

Removable parts
Optimized drive control
The new motor gives new freedom for the design of mill layout. The solution provides a high torque drive directly coupled to the in-drive of the paper machine section.

For a such direct coupling with a conventional motor construction, the in-drives of 300 rpm to 600 rpm would need a considerably bigger motor frame than that of a 1500 rpm motor. The new motor type is, in most cases, the same size or even smaller than the existing induction motor.

This means that in most cases mechanical drives can be limited to the coupling between the drive motor and the paper machine section.

Further the number of components and maintenance needs. The result is an even more robust drive.

Permanent magnet motor for improved control accuracy
The actual motor design is a radial flux construction, an air or water cooled motor, with permanent magnet rotor.

- Powers from 27 kW to 700 kW
- Nominal speeds between 300 and 850 rpm
- Motor voltage 400/690 VAC

Water cooling offers the most compact and efficient solution for both motors and inverters.

The motor is synchronous, which means no rotor slip. With an asynchronous motor, slip varies according to speed and load. Without the slip, the static accuracy of the motor speed is optimal and the dynamic motor control performance is enhanced by eliminating the need for slip compensation.

Direct Drive technology improves drive controllability thus enabling the paper machine drive to run without a pulse encoder. This reduces
Also, audible motor noise is lower than that of a traditional motor, due to the new motor construction and water cooling.

The temperature of the permanent magnet rotor remains naturally low and, when using the standard water-cooled frame, the power density and protection class can be designed to be high. In a harsh environment, this provides increased motor reliability and enables higher process availability.

**DTC control for high performance**

Since this motor is of synchronous type, it can only be controlled by the dedicated inverter control of such a motor. Furthermore, the synchronous motor control must be especially developed for permanent magnet flux control. ABB's unique DTC control method is now at this third generation stage. The DTC technology was launched in mid nineties with considerably improved control features for induction motors. Now it is also available for the permanent magnet motor.

**Frequency converters with air or water-cooling**

The Direct Drive system is based on ACS 600 MultiDrive frequency converters. The significant feature is that the new motor control can be utilized for exactly the same inverter hardware as the induction motor control. The converters can be air-cooled or water-cooled.

Water-cooling leads to higher power density and compact drive cabinets, and the higher protection class enclosure allows more freedom for drive placement and reduces the ambient exposure of the drive components.

**Advanced Drive Solution**

The drive control system, application software, and human system interface are the same as with the Paper Machine Concept 200™ drives.

This ensures that the new ControlIT compatible Direct Drive can communicate and also be used in parallel with older ABB drive systems. Furthermore, it enables the operation and maintenance personnel to put Direct Drive to efficient use immediately.

### A number of technical improvements

- Multiplied torque output
- Optimal motor size
- No need for pulse encoder
- Less power consumption
- Reduced noise levels with water cooling
P&P Drives Network. World Class Productivity.

Local consulting and customer support via the P&P Drives Network
The ABB pulp & paper drive solution is more than just a system delivery. It includes all the components needed for total life-cycle asset management:

- Engineering standards and tools
- Tested application solutions
- Maintenance tools
- Commissioning
- Training services
- After sales services

ABB's P&P Drives Network offers drives expertise close to our customers in all parts of the world.

The highly qualified ABB personnel ensure smooth and effective project execution from the design phase to the fine-tuning in production. The re-use process enables fast project execution and reliable quality of work. The 24/365 Support Line ensures the availability of the best skills in drive systems and applications at any time.

For the Direct Drive solution the high level re-use of conventional solutions and modules means fast and effective implementation of state-of-the-art technology - to make paper-making easier than before.
**Support for Highest**

**ABB IndustrialIT - Direct Drive**
The Direct Drive solution is based on superior root technologies and best-in-class components from ABB. These components - drives, motors, automation with value added applications - interact seamlessly as an integrated drive system.

In addition to the common communication interfaces, the drive control features are developed for widespread real-time information sharing and intelligent access to a vast array of measurement and diagnostic data, in the right form, exactly where needed.

**Direct Drive for Improved Environmental Care**
The better electrical efficiency of the Direct Drive has a direct impact on power consumption. The total savings increase considerably when maximum production speed is not necessary.

Some environmental advantages such as better working conditions for production and maintenance personnel, are indirect and qualitative, but also result from the implementation of the new Direct Drive technology.

**Join the Success!**
The Direct Drive technology brings a great number of improvements to paper manufacturing. With this technology ABB is once more changing the paper industry.

**Strong system back-up**
- Unchanged operator interfaces
- Easy to use system
- No need for additional training
- Same system control
- Skilled support personnel
- Excellent availability of support