Variable Speed Drive Operating Refiner in the Pulp & Paper Industry

Drive^{IT} ACS 1000 medium voltage drives for speed and torque control of 315 kW – 5,000 kW motors

Case Study

Pulp & Paper industry

Horizon Pulp & Paper, Estonia

Application: High Consistency Refiner, 3500 kW

Horizon Pulp & Paper

Horizon Pulp & Paper is an independent, fully integrated pulp and paper mill located in Kehra, Estonia. The mill produces and exports sack kraft paper, sacks and a variety of tissue products. It is a member of the Tolaram Group, an international company with vastly diversified activities, including manufacturing of textiles, fibres and polymers and pulp and paper.

In 2001 Horizon invested in modernization of the Estonian paper mill. The site's recovery boiler, paper machine no. 1 and the refining system were upgraded.

High Consistency Refining System

In the paper production process, refiners separate wood fibers from wood chips. Thermo-mechanical pulping (TMP) with a pressurized refiner is a commonly used refining process.

At Horizon, the advanced high consistency (HC) refining is done with a RGP-250 refiner at a consistency of 30–33%. Depending on pulp characteristics and quality, the typical input is 300–380kWh/t.

Challenge

In order to start the 3.5MW medium voltage asynchronous refiner

Highlights

- Start-up of refiner motor without voltage drop in supply network
- Minimized total investment
- Increased availbility
- Reduced maintenance cost
- Extended lifetime of equipment

View of Horizon's pulp and paper plant in Kehra, Estonia.

View of the motor and the refiner.

The ACS 1000 medium voltage AC drive (3,500 kW) controlling the refiner.

motor, certain requirements had to be met:

- Horizon had to be able to start up the refiner independent of the supply network's working parameters. In addition, the start of the asynchronous motor should not cause any disturbances in Horizon's existing automation equipment.

- Eesti Energia, the local electricity utility company, requested that voltage drops at 35 kV supply lines must not exceed 4 %.

Solution

As neither direct-on-line (DOL) nor reactor start up met the requirements of both Horizon and Eesti Energia, Horizon decided to use a variable speed drive to start the refiner motor.

The following criteria were taken into consideration:

- Efficiency of the overall power chain
- Maintenance costs
- Availability

ABB was chosen as supplier for the HC refiner drive system due to the following advantages of ABB's ACS 1000 medium voltage drive:

- High availability
- Minimum investment in other parts of the mill
- Short installation time
- Low operating and maintenance costs
- Output capacity

Benefits

Soft starting

During the starting process, the ACS 1000 variable speed drive (VSD) progressively increases the motor speed and accelerates the load smoothly to its rated speed without causing torque or current peaks.

By operating the refiner motor with a VSD, the requirements of Horizon as well as the utility company are fulfilled and even exceeded.
No disturbances are caused to Horizon's existing automation equipment and pratically no voltage drop can be detected during refiner motor start at the 35 kV supply lines, even in weak power grid conditions.

Increased lifetime of equipment

Soft starting of the refiner decreases maintenance costs as stress on the motor and the refiner is reduced.

No need for power factor compensator

Due to the natural commutated diode bridge, the power factor is independent of speed and load. The effective power factor is equal or better than 0.95.

Direct Torque Control (DTC)

The ACS 1000 motor control platform is based on DTC, which allows direct control of all core motor variables thus responding to process changes extremely fast. Short supply voltage interruptions, from few cycles to few hundred milliseconds, will have no effect on the refiner drive system, due to the Power Loss Ride-Through function of the ACS 1000.

High Reliability & Availability

The ACS 1000 uses the IGCT (Integrated Gate Commutated Thyristor) power semiconductor as an integrated protection device. This leads to a lower parts count, making the ACS 1000 a drive with outstanding reliability and availability.

Customer Satisfaction

Horizon Pulp & Paper states:
"We would like to thank ABB for their excellent work. The installed drive system fulfills all specified requirements and is running well with no problems."

Key features & benefits

The ACS 1000 medium voltage drive offers many benefits as standard, including:

- highest reliability and availability
- high efficiency, > 98 % including sine filter and auxiliaries
- smallest footprint and overall physical size
- greatest transformer flexibility
- high performance, through Direct Torque Control (DTC)
- retrofit-ready, for fitting to any standard medium voltage squirrel cage motor, without derating
- every drive fully factory-tested
- two-day on-site commissioning
- full compliance with international standards including EN (IEC), CE, IEEE, and the first medium voltage drive to be UL Listed.

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