On a Roll:Paper Mill UsesDC DriveTechnologyin Major Retrofit

New DC drives debut in the slitter-rewinder machines at a leading paper mill in the Southeast. The results? The plant has increased production and improved roll quality while virtually eliminating shutdowns

The U.S., according to the Federal Network for Sustainability, uses about 8 million tons of office paper annually. That's enough to build a wall 20 feet high and 6,815 miles long. To keep up with demand, paper mills look for ways to improve efficiency and quality. While there are many different machines and processes involved with papermaking, a vital part of any paper mill is the slitter-rewinder.

A slitter-rewinder is responsible for unwinding huge rolls from the main papermaking machine, cutting them into smaller sections, and rewinding them into manageable rolls for distribution. A problem with the slitter-rewinder can halt production for the entire mill. Consisting of multiple motors and controls, it's one of the most advanced pieces of equipment in a mill. At the heart of this machine's process is tension, which determines the quality of the paper rolls. Accurate and consistent forces need to be applied throughout the process to ensure perfect web tracking, precise slitting, and proper roll density profiles

Except for nip control, the quality of the roll is governed largely by the performance of drives. The winder must run as a coordinated system and provide tight control of speed and torque through continual cycles &#151 from stop to full speed and down to zero speed. Even small inaccuracies in performance can cause problems, such as sheet breaks, rough edges, telescoping, offsets, and tie-ups, resulting in downtime, rejected rolls, and lost profit.

To increase productivity and efficiency, one leading paper mill in the Southeast decided to rebuild its slitter-rewinder to incorporate the latest technology. The goal of the upgrade was to improve roll quality, increase machine speed to the highest possible level, and eliminate shutdowns. The mill turned to SDS Inc, a U.S.-based systems integrator that specializes in control designs for the paper and web handling industries. SDS provided a solution that used existing motors and components but integrated drives from ABB, a process automation leader and manufacturer of motor drives with facilities in New Berlin, WI. Chosen were ACS800 AC drives and new DCS800 DC drives. The drive hardware was rounded out with SDS's Intelli-Wind, a two-drum winder HMI that provides tension, nip, and torque control, recipes, numeric and graphical setpoints, permissives, and diagnostics.

The paper mill was among an increasing number of manufacturers still operating with drive systems that are 25 to 30 years old. The drive system on the slitter-rewinder was becoming expensive to repair and maintain. A number of components had become obsolete and could not be replaced. Some of the analog equipment

needed constant attention due to drift, and old wiring was showing signs of fracture and insulation breakdown at hinged points. The mechanical assemblies that held the thyristor assemblies and fuses in place were beyond repair. Moreover, there were issues with the structural integrity of the power modules.

Craig Tierno, senior application engineer with SDS, said these problems made it impractical to consider a retrofit that would replace analog regulators with digital counterparts while maintaining the existing power bridge. The SCRs inside the power modules would not be dependable. As a result, the integrator recommended a complete drive and control system upgrade to improve reliability and performance. "Often, if a company's DC power modules are still within their life cycle, we will recommend retrofitting them with new digital, high-performance front ends to enhance the regulation performance while firing the existing SCRs. In this case, we could not do that," explained Tierno. "Our biggest concern was that drive suppliers were not doing anything new with DC. Most of the suppliers were sitting on products that were near 10- to 20-years-old." Tierno learned that ABB was developing a new DC drive designed with some of the same software tools and communication modules as its AC products. The technology made it feasible to use and integrate both DC and AC products in the project.

Four DCS800 drives were installed. The first drive controls the 500-HP unwind motor, which provides tension regulation for the jumbo parent roll. The second was installed on the 50-HP lead-in paper roll, which is used to transport the paper to the slitter section. The third and fourth were installed on the 250-HP front and rear drums &#151 components that are responsible for providing machine speed reference and profiling torque to the re-wound roll. Due to the size of the rolls and the demanding torque required to accelerate and decelerate, all the DC drives were sized to handle 200 percent current limit for one minute.

Two ACS800 AC drives and motors rated at 15 HP were connected to the two ends of the rider roll to provide vertical force for acceleration and deceleration torque. From a mechanical viewpoint, the motor frame size was based on the application horsepower and ventilation style since the motors are mounted within a moving rider-roll frame.

The load cells, which measure web tension on the unwind section of the machine, were replaced with PillowBlock-style Pressductor transducers. The PFTL units were selected because of system requirements and because they would be direct physical replacements for the old load cells. The new load cells were from ABB and came pre-calibrated for the application.

The system integrator installed its own winder-operating software called iWind, which is designed to optimize roll profile and quality while offering automatic stopping, product recipes, numeric and graphical setpoints, permissives, and full diagnostics. It merges the various control equipment directly with the drive hardware, resulting in a less complex system that provides increased performance.

Primarily focused on tension, nip, and torque, SDS was able to create an architecture that met the customer's need for improved roll quality. The automatic

stopping feature solved the mill's problem of product length and diameter. Permissive and diagnostic pages helped operators keep the winder running and reduced support calls to maintenance. The recipe system allowed operations to set up orders quickly and maintain product consistency.

The retrofit used existing construction &#151 an open-panel design that required minimal real estate and clearance in the control room. Instead of using floor-mounted cabinets, all power modules, circuit breakers, and other components were laid out on elevated panels. This enabled the integrator to pre-build a separate sub-panel for each drive, allowing time before demolition of the old equipment to test the drives individually and as a group. This made it possible for all communications between the drives and much of the application software and drive functionality to be tested thoroughly before installation and commissioning.

The setup and commissioning of the application program was a smooth process. It took the system integrator team approximately four weeks to engineer the schematics, create the drive and controller software, and build the panels. After two weeks of testing, the team was able to install the new equipment within the five-day contingency the mill required. Engineers remained on site for a few days after startup to ensure a seamless transition for the plant operators.

Since the installation of the DCS800 and ACS800 drives, the mill has been able to realize its goals of increased production, top-speed efficiency, better roll quality, reduced maintenance, and minimal shutdowns. In fact, it has been able to virtually eliminate the shutdowns that happened previously due to component malfunction.

*Additional information about the AC and DC drives used in this retrofit is available by contacting ABB, 16250 W. Glendale Dr., New Berlin, WI 53151, calling 800-752-0696, or visiting www.abb.us/drives.*SIDEBAR:

Just the Facts About Retrofit's Goals

SDS's John Parker recounted the major goals of the retrofit as follows:&#149 The production department needed to increase uptime, improve roll quality, and provide customers with a cost-effective product. The mill also wanted to use technologically advanced equipment.
&#149 The maintenance crew wanted to address its concerns regarding component failure and a drive room that required precise temperature control to keep analog components from drifting.