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THE CASE FOR REGENERATIVE AC DRIVE MOTORS

**A practical alternative to mechanical braking and non-regen drives systems
in the converting, packaging, wireforming and printing industries**

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During the operation of any converting machine, whether for film, foil, wire, paper or board, plus most large printing presses, rolls of materials are handled by unwinds, often still driven by pneumatically operated braking systems. The traditional tension control system for an unwind stand is a simple mechanical brake. In principal, the unwind brake mechanically operates much like the braking system on your car, with a disk, caliper and pads, but is controlled by a tension sensor linked to a setpoint controller. As the roll unwinds, the tension is maintained by the brake for smooth passage of the material through the dies or rollers, resulting in better package alignment, less wrinkling, better print registration, even more consistent wire dimensioning and other production positives. These mechanical brake unwinds are effective in controlling the tension, but have inherent problems of heat and power loss, plus mechanical wear and constant maintenance needs, substantially impacting machine uptime.

The typical mechanical brake is pneumatically controlled and may utilize several sets of friction pads to control the web tension as the roll dimension decreases. Plus, a reasonable pressure range in many applications might be from 15-90psi

or a 6:1 drop, a range significantly less than the core to full roll ratio for most jobs, an obvious inefficiency in operation.

To affect good tension control on the brake, these friction pad sets need to be manually changed in an out of the brake assembly, depending on the desired operating tension and the roll diameter changes involved. Often, the adjustments are several per roll during this manual changeover. Because the mechanical brake creates the unwind tension through friction, it generates substantial heat and often requires a separately powered fan for cooling to operate effectively. This friction also means the pads are subject to rapid wear, requiring frequent and time-consuming changes or maintenance checks.

For almost a decade now, this old technology has been gradually replaced, though usually in the lower power ranges, by newer precision technology, involving AC motors, drives and electronic loadcells. On converting lines today, a further leap forward is being made with the onset of active front end technology.

With such technology, the operating principle is as follows.

Since the unwind application is regenerative (regen) in nature, a driven unwind needs to return the energy that the mechanical the brake produced as heat back to the AC line. In the past, regen DC drives have been successfully applied as driven unwinds, but DC drive systems are no longer common and even during their prime were very costly. Early in the AC drive technology for these applications, the drives did not have the capability to regenerate the power back to the AC line and, when applied as unwind brakes, required regen resistors to dissipate the tension energy. This was wasteful and costly.

Today's AC drive systems now have the technology to regenerate the energy back to the AC line just as the DC drive did, but with added benefits to the user and machine designer alike. Sending the tension energy back to the line means

power that once was wasted can now be retained, instead of the system producing heat and worn parts. When the drive is equipped with active front end technology, it will return the previously wasted energy with near unity power factors, something not possible for any DC drive system.

Even an open loop AC drive motor combination offers a tension control range far beyond the limits of a pneumatic braking system. Synchronous AC motors can offer precision open loop torque control without a tension sensor, thereby saving further cost and inventory. Today's highly accurate tension control systems can be designed with high resolution (sin/cos) feedback encoders on both the unwind motor and dancer position feedback. Additionally, in more advanced active front end designs, the regen capability of the drive can actually assist in the increase of stopping times and tension control regulation, owing to the four quadrant control, i.e., the motor can sink or supply current to the motor in both directions.

AC regen drive systems can also offer today's machine designer software configurations with a wider range of control flexibility. They can be configured to operate in the most basic mode with no motor encoder or with tension feedback to system configurations, utilizing either dancer position sensors or loadcells. Alternatively, they can function as a programmable logic controller (PLC), controlling the machine functions on the unwind, while also connecting directly to a human-machine interface (HMI) panel. In most converting, packaging and printing applications, the dancer position sensor can be used to calculate the starting diameter of a roll, eliminating additional diameter sensors and the possibility of operator error in the roll diameter input. Further enhancements for unwind spindle motion such as jog for threading have also emerged for operator convenience through active front end technology.

Beyond the obvious cost savings of pad replacements on mechanical braking systems, AC motors are virtually maintenance free by comparison to DC motors, as AC motors have no brushes, do not require controller contactors to reverse

direction of motor rotation or have commutators. Fewer moving parts invariably means less motor maintenance, for additional cost and time savings.

In the most advanced systems, common DC bus regulation, energy-monitoring devices for near unity power and, through the use of mechatronic services often provided by the manufacturers, “turn off” parameters in vector drives are possible. Mechatronic services can also be utilized for the proper tuning of these drives onsite or during machine build. For designers, such services further assist in the proper sizing of motors, based on the mechanical and electrical forces generated by machine operation or computerized simulation of it.

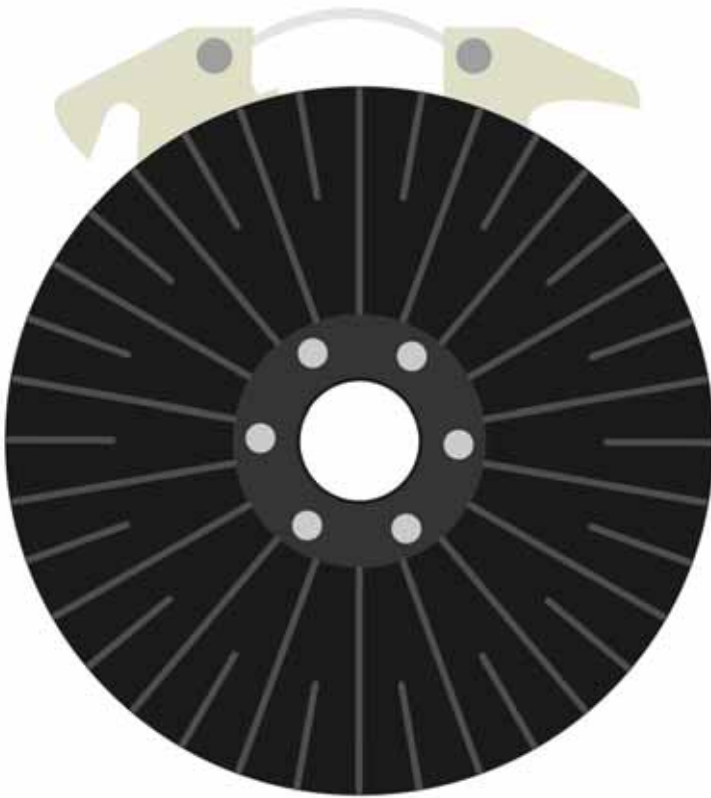
This combination of improved operation, reduced maintenance, motor power savings and conservation of nearly all energy within the system make AC regen drives with active front end technology a decided advantage for machine designers and end users of converting, packaging, printing, wireforming and other roll-fed machinery, where driven unwinds can be implemented.

For more information on regenerative drive motors and systems, please contact:

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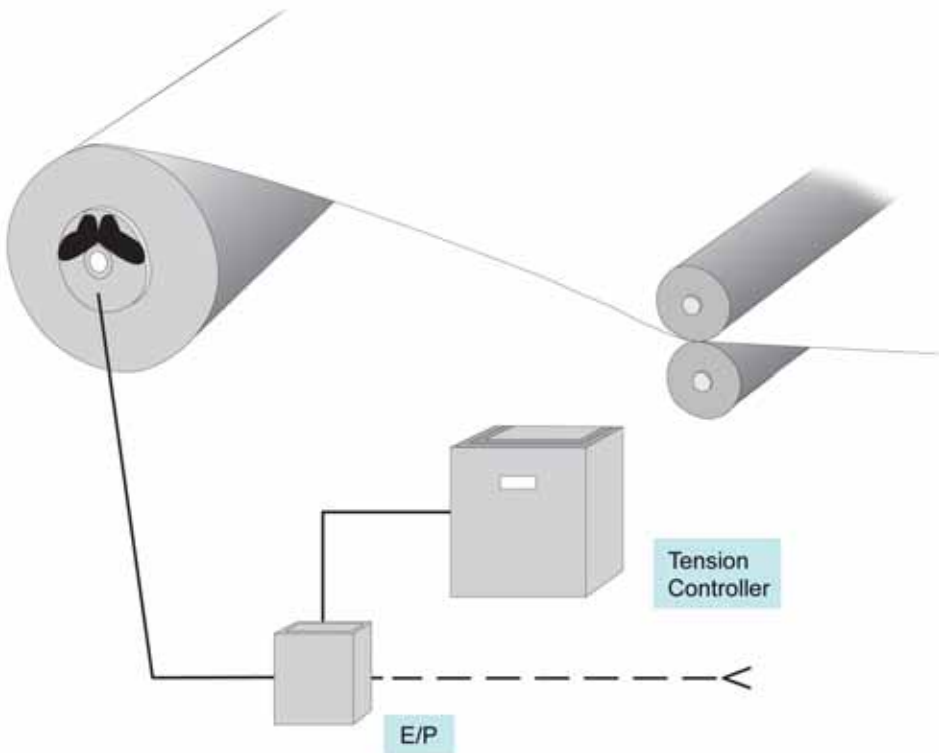
(illus1)

The unwind brake operates much like the brake on a car, with disk, calipers and pads. The tension is linked to a position controller.



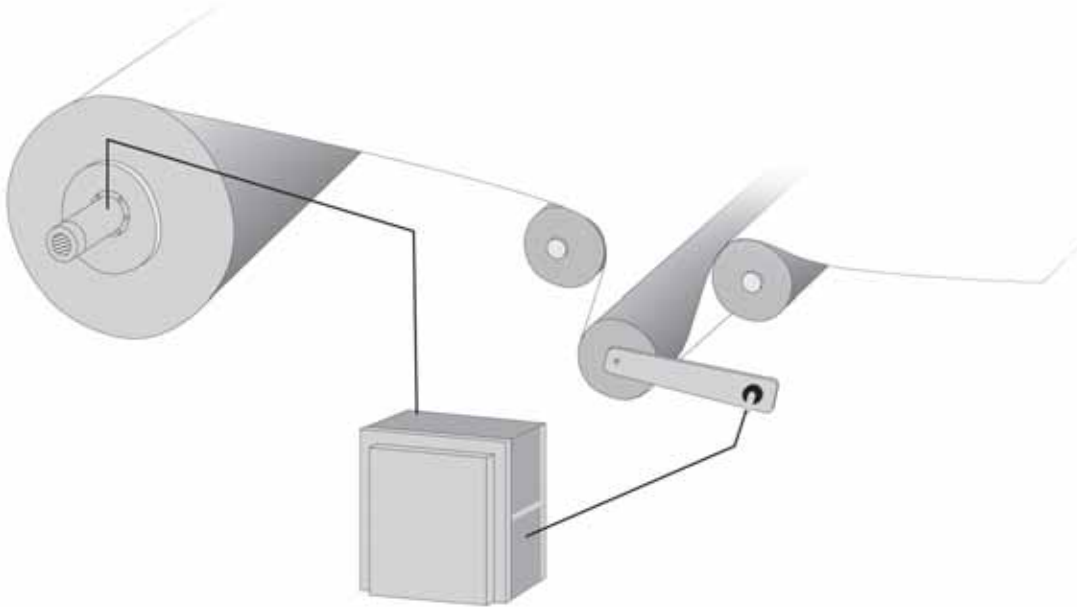
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Conventional mechanical brake system



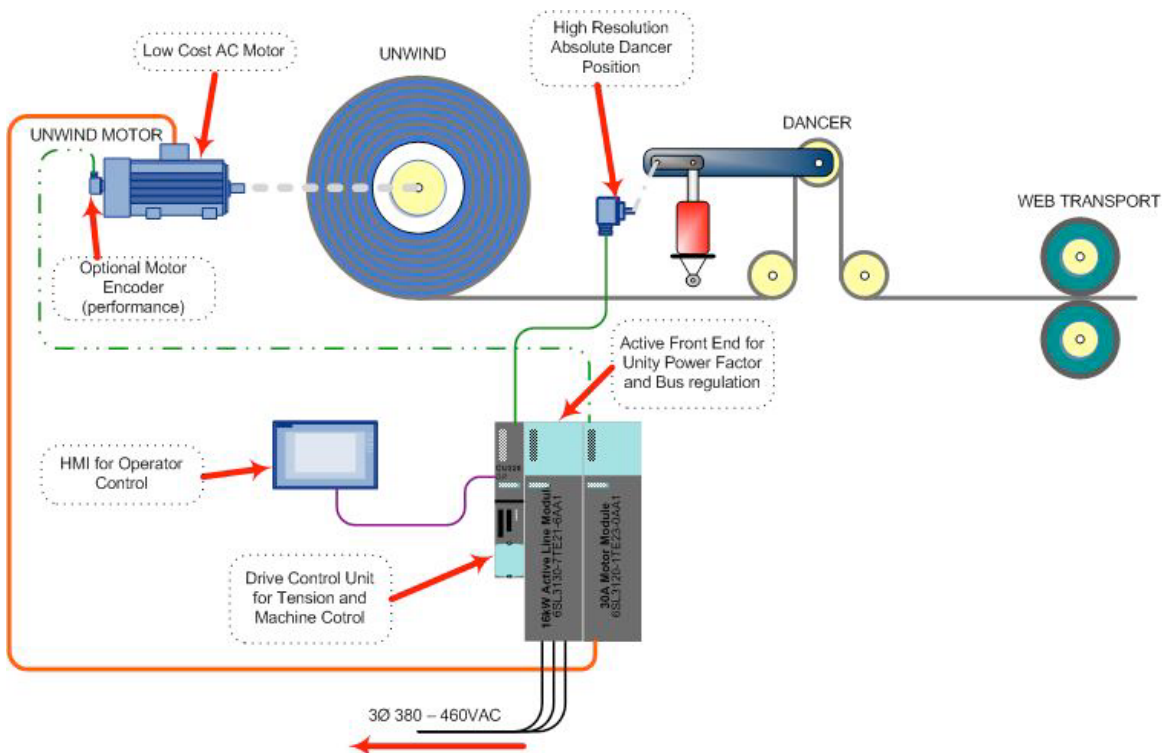
(illus3)

Driven unwind with AC regen motor, drive



(illus4)

This schematic shows the typical driven unwind system in operation



Editor Note: Siemens will make the author as well as various other product and market specialists available to you for interviews on the many aspects of regenerative drive motors detailed in this article, as they apply to the particular nature of your audience. Please contact the agency to arrange. Thanks!

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