YASKAWA

AC Drives Minimize Factory Maintenance Problems

Advances in technology continue to provide increasingly flexible, capable and reliable ac drives. The broad capabilities of these new drives may make them appear more complex than they really are. There is, however, no reason to feel overwhelmed by recent drive technology, because like personal computers, ac drives have not only grown more compact and powerful, but they are easier to use.

This article will look at how these modern ac drives can help maintenance departments apply evolving technology to reduce maintenance worries without having to earn a Ph.D. in electronics or computer programming.

Machine Maintenance

Machine maintenance generally falls into three categories: set-up, preventive maintenance and repair. All three areas can demand large amounts of time and expense. All three offer considerable potential for improvement. Compact, economical ac drives can provide savings of both time and money in all three of these critical areas.

Setup of a production machine, be it on a new line or a product changeover on an existing line, is usually the responsibility of the maintenance department. Setup may involve adjusting speeds on conveyors, fans, pumps or other motorized equipment. Often these process variables must be changed within individual production runs as well, possibly several times a shift.

Setup changes can be as difficult as replacing a gear or pulley (and occasionally the entire gear box) or as simple as changing the tension on a mechanical holdback or motor winding connection. Such mechanical changes, however, can create wear and tear on the equipment and introduce inaccuracies and inconsistencies to the overall system.

Replacing these mechanical devices with compact, economical ac drives permits speed and process changes to be made in seconds. This is a fraction of the time needed to make the adjustments mechanically, with no wear and tear on the equipment. Once the ac drives are installed, changes can be made through simple adjustments. Changes can even be made on the fly by a signal from a PLC or similar process controller to the ac drive, so the production line never has to stop. This can save enormous amounts of set-up time and expense in almost any operation.

Preventive Maintenance required by various mechanical methods of speed control can contribute considerably to the cost associated with these devices. Gears and gear boxes need to be lubricated, with mechanical wear eventually necessitating replacement. Belts need constant adjustment to accommodate stretching. Belts also wear out, and an unexpected break can shut down an entire production process, wasting product and money. DC motors require regular maintenance on commutators and brushes.

AC Drives Minimize Factory Maintenance Problems

An ac motor/drive combination can provide many years of service without so much as a preventive maintenance check. Recommended inspection intervals on these drives are once every three to five years. AC drives and motors have no mechanical wear other than the motor bearings.

Repair. In the event of a failure, a mechanical system can easily damage itself and the driven machine. As a belt strips off the pulley, it can disintegrate, posing a safety threat.

AC drives are designed to be self-protecting and thus anticipate problems before they cause damage. The drives can warn the operator of problems. The operator can then make adjustments to compensate or shut down. AC drives are designed to limit internal damage by sensing problems electronically, correcting the situation whenever possible, or shutting down.

Repairing damage caused by mechanical drive box failures can vary from replacing a gear to replacing the line section. This can be extremely costly in terms of expense and lost production. Repairs can take hours, even if the replacement parts are in stock and damage is minimal, or days to weeks if the parts must be special-ordered or built.

Repairs to equipment utilizing ac drives can be simplified by the drive's built-in diagnostics and modular design. Diagnostics can pinpoint the problem instantly, with replacement or adjustment accomplished in minutes.

AC drives also can be provided with a bypass option that allows motors to be run from either the drive or directly from the ac line. This can be of vital importance in critical applications requiring continuous operation, including cooling fans, pumps and other process equipment.

AC Drive Reliability has progressed as rapidly as the technology. For many recent drive designs, the calculated MTBF is above 280,000 hours. That translates to more than 28 years if used 24 hours a day, 365 days a year. Advances in technology and experience in ac drive design account for the long MTBF.

The development of Insulated Gate Bipolar Transistors (IGBTs), surface mounted devices (SMDs) and advances in software techniques have had the most profound effect on reliability. IGBTs are able to handle higher power levels than the bipolar transistors they replaced. Surface mounted devices have proven to be more reliable than older technologies, especially in hot or hazardous environments.

Software techniques used today, including current limit, stall prevention, overvoltage and electronic motor overload, help protect the drive and motor from harm before damage can occur. A computer chip replaces analog circuits and hardware and has led to drives that incorporate fewer parts to troubleshoot, repair or replace.

Computer technology has also led to faster, easier troubleshooting methods. No more searching for test points and hand-measuring voltage levels. Most diagnostics are built in, so if a problem occurs the drive communicates the problem and its source.

Return on Investment. Regardless of how well a product performs or how advanced it is, the bottom line for any investment is how much it will save in the future and how fast it will pay for itself. This is where the compact, modular ac drives prove themselves.

Modern ac drives offer a combination of long operational life and short payback cycles. While providing many of the same benefits of larger, more complex drives, compact drives are quite economical. Initial installed cost is generally the only cost, since virtually no preventive maintenance is required.

AC Drives Minimize Factory Maintenance Problems

Increased Production, Improved Quality
The overall production process can be optimized with line speed control provided by compact ac drives. Increasing the speed of sections or the entire process line improves product throughput. A more uniform, controlled process provides improved quality in the process and final product. The tight process control provided by ac drives produces less waste and a greater yield of finished product.

Programmable controllers and other forms of automation can be used in conjunction with the drives to provide even tighter process control. When used with these intelligent process controllers, many adjustments can be made on the fly. This is less time-consuming than process changes in mechanical systems.

Additionally, the flexibility of ac drive systems allows vastly different products to be manufactured on the same production line. Drive flexibility ensures that the manufacturer gets the most efficient use of his manufacturing equipment and factory floor space.

Inventory savings do not stop with parts for the drive. If many motors of approximately the same size are used throughout the process, it may make sense to standardize on a few drive sizes.

The flexibility of these devices allows them to be used on almost any standard induction motor that requires less current than the maximum rating of the drive. Using only a few sizes will reduce the replacement inventory needed without hurting the efficiency of the process. Stocking a few complete drives is significantly less costly than stocking every possible gear or pulley combination used in a production process.

Energy Conservation
An additional, and important, consideration in the application of ac drives is their ability to provide cost savings through energy conservation. Utility companies charge premiums for peak demand and poor power factors. Today's ac drives help create more efficient systems that use less energy than mechanical systems. Because the drive allows operation at optimum motor speed rather than a constant full speed, less energy is consumed. Resulting energy savings can be considerable, and in HVAC applications within the plant the drive will usually pay for itself on this basis alone.

Modern drives are also constructed with input diode rectifiers that exhibit a constant power factor of .98, which is much better than that of a standard ac induction motor.

Due to the demand for electrical energy outpacing the ability of the utilities to increase supply, many power companies are offering rebates for energy efficient devices, including motors and drives. These rebates can be considerable, with some paying for up to two thirds of the total cost of the drive. This makes the cost savings or payback equation even more favorable.

Conclusion
AC drives allow today's manufacturer to squeeze the most out of the manufacturing process. They provide the tight process control needed for quality, high-yield production, with little waste. AC drive advantages over mechanical systems include quick set up and adjustment, virtually no preventive maintenance requirements, and a proven track record of reliable operation.