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Copper in Motor Repair Facilities

Three electric motor repair facilities share their best practices for utilizing copper in motor repair and selling new motors to replace older, less efficient motors.

The Motor Repair vs. Replace Decision

Electric motor repair service providers are well equipped to sell new Premium Efficient® electric motors and to restore worn-out motors. Nationwide, motor repair shops account for about 50 percent of all new motors sold in the marketplace, due in part to the trust placed in the shops for superior repair, sage advice and long-standing relationships. While the service providers will educate and guide the customer in purchasing a new motor, motor repair may be the preferred option due to improved efficiency and for reasons relating to cost, size, functionality or criticality. Not all motors are candidates for replacement – repair is sometimes the best option. Therefore, restoring an electric motor to, or as close to, its original efficiency is beneficial for both the consumer and the repair shop, and ultimately for the copper industry.

In this case study, the practices of electric motor repair facilities are highlighted in the sale of Premium Efficient® electric motors and in rebuilding and restoring older motors with copper in the stator windings and with improved bearings and insulation. Quality repair shops that adhere to the ANSI/EASA AR100-2015 Standard *Recommended Practice for the Repair of Rotating Electrical Apparatus*, provide the best techniques in electric motor restoration by employing high-level methods of repair, which use a significant amount of copper. For publications on the criteria for selection of a motor repair shop and for references to industry standards such as ANSI/EASA AR100-2015, please visit to www.copper.org and www.easa.com.



Electric motor service companies participating in the study include KJ Electric www.kjelectric.com, FLOLO Total Services Group www.flolo.com and Industrial Motor Services, a division of EECO (Electrical Equipment Company) www.eecoonline.com.

KJ Electric has offices in Syracuse, New York with satellites in Albany, Rochester and Buffalo.

The FLOLO Total Services Group, located in Illinois, has four facilities: Franklin Park, Calumet City, Gurnee and South Elgin.

EECO has locations in Richmond, Virginia; Raleigh, North Carolina; and Augusta, Georgia. Each is a respected member of their community, providing reliable and comprehensive services for all motor-related needs.

The actual locations of the motor repair facilities visited for this paper were: KJ Electric in Syracuse, New York; FLOLO Corporation in Franklin Park, Illinois; and EECO in Richmond, Virginia.

Electric motor repair service providers are well equipped to sell new Premium Efficient® electric motors and restore worn out or failed motors. Based on our interviews, the business distribution between the supply of new motors versus the repair of old motors varies between repair shops. At KJ Electric, they estimate approximately 80 percent of their business entails new motors sold compared to 20 percent made up of repaired motors.



*Charles Streu, Corporate Staff
FLOLO Corp.*

Charles (Chuck) Streu at FLOLO stated that, "New Premium Efficient® motors sales are substantially more than that of our motor repair work. We estimate our business at 65 percent new motors sold and 35 percent repaired."

At EECO's Industrial Motor Services, the distribution leans more toward motor rewinding with 32 percent new and 68 percent repair, primarily driven

by their service to the heavy-duty, high-horsepower motors used in the forest products and chemical industries.

The criteria for horsepower cut-off point for motor repair or replacement also varies across repair shops and is between 25 and 50 horsepower, but that cut-off point is primarily customer driven. A better method of making that repair versus replace decision involves the use of software tools to evaluate the motor for repair or replacement. This software is often provided by the repair shop or motor manufacturer.

This is where motor repair shops provide valuable services to their customers in the motor repair or replace decision. Even if the old motor is repairable, it might not be the best immediate or long-term financial decision for the customer. For every motor coming in for repair, a repair shop will perform a failure analysis and, in many cases, will provide an inspection report to the customer. This report presents them with the option of a repair and its cost, or a new replacement motor, showing the price versus the long-term energy savings associated with the Premium Efficient® motor.



Kenneth Jacobs, CEO KJ Electric Corp.

Kenneth Jacobs, CEO of KJ Electric, stated that "Aside from special purpose motors, every customer that brings a motor into KJ Electric for repair receives two quotes: one for repair and one for a new Premium Efficient® motor. Most of our customers have a 50 percent threshold when it comes to the repair vs. replace decision. If the cost of repair exceeds half the price of a new

motor, they opt for the new motor. I encourage buying new rather than repair for motors below 50-horse power. This is an easy decision for the customer, because the repair cost is prohibitive for the lower horsepower motors and the customer ends up with a more efficient motor. If it is warranted, we will repair a motor over 50 horsepower."

Increasing Motor Efficiency with Copper

In most cases, the new motor represents a significant increase in efficiency primarily because of the increased amount of copper in the stator windings of higher efficiency motors.

Once the decision is made to repair a motor, its core is tested to validate that the magnetic properties of the core will support a copper rewind before it can proceed to the next step, which is the motor burnout in a temperature-calibrated oven in order to prevent any damage to the iron core. Following the burnout and the subsequent removal of the old insulation and copper, the core is reinsulated, rewound with new copper and vacuum impregnated with resin to protect it from chemical and moisture contamination.



Typical copper scrap after motor burn out at EECO

A rushed repair is a bad repair. Taking shortcuts in the repair process to get a quicker turnaround time for the customer is not sound practice.



Kenny Jacobs, Controls and Drives Manager, KJ Electric

"It is our responsibility to explain to the customer that it takes a given amount of time to burn their motor correctly so that we can return to them as efficient a motor as they brought to us for repair," says Kenny Jacobs, the controls and drives product manager at KJ Electric.

Burning a motor at too high a temperature in an attempt to shorten the time for a repair creates hot spots, reduces the efficiency of the motor and leads to early motor failure. At EECO, some motors with very large cores use a faster, safer and more economical high-pressure water coil stripping to remove the copper and insulation. This

alternative leaves the motor core very clean, facilitating new copper coil installation.

A lot of copper flows in and out of these repair shops, according to Frankie Johnson, the motor winding jobs manager at EECO.

"With three winding facilities we use a lot of copper; 75,000 pounds or 34.5 tons of new copper and we reclaim about the same amount in scrap annually," said Johnson.



Rolls of new copper wire used in motor rewinds at FLOLO

EECO's Industrial Motor Services specializes in the forest products industry, where heavy load demands put a lot of stress on the larger motors. Johnson continued, "The Richmond and Augusta locations rewind the larger motors. With 8-foot VPI (vacuum pressure impregnation) systems at each of those two facilities, we have repaired motors up to 3000 horsepower. When the Raleigh winding facility has the larger jobs, we have them vacuum pressure impregnated at one of the other two locations."



8-ft. Vacuum Pressure Impregnation (VPI) System at EECO's Industrial Motor Services in Richmond, VA

For the repair shop, the repair part of the business is a gateway to new motor sales. New motor sales equate to typically higher efficiency due to the increased use of copper, as well as other materials including bearings and insulation. These repair shops encourage their customers to buy new Premium Efficient® motors rather than repair a less efficient Standard or Energy Efficient motor where it makes economic sense. Sometimes the customer does not comprehend the savings from installing the new Premium Efficient® motors. The savings in energy over a seven-year period alone are worth as much as five times the price of the new motor, according to Jacobs.

In addition to the mechanical improvements, manufacturers have made significant upgrades in the design of Premium Efficient® motors. By adding more copper in the windings – higher grade iron in the core and better insulation – they have increased the energy efficiency of these motors. One manufacturer, Siemens, has a Copper Rotor Motor with improved efficiency above the Department of Energy's (DOE) Premium Efficient® label.



500 Horsepower motor undergoing new copper coil insertion
(photo courtesy of EECO)

To quote Jacobs, "There are two categories of customers: those seeking the lowest initial price and those looking at the long-term cost of running a motor. The price of buying a new motor or repairing an old motor is very inexpensive compared to the operating cost of a motor over a 10-year cycle. Looking past the initial price is a challenge for some customers."

In terms of data from the DOE, the purchase price of a motor represents 2 percent of the total cost of ownership; operating costs represent the other 98 percent. To help customers understand the long-term cost benefits of swapping out an old motor for a new Premium Efficient® motor, KJ Electric will introduce the customer to the free motor survey programs either through the sales representative or through direct mail.

Conclusion

When the decision is to buy new, the companies interviewed are well prepared to deliver from their inventory of Premium Efficient® motors, and have arrangements with motor manufacturers to fully meet their customer's requirements. In these new motors, copper is a significant contributor to the increased efficiency. Combined with a solid preventative maintenance program, you not only get lower energy costs with the new motor but also less concern for future motor repair needs.

All three of the companies provide services to their customers beyond assisting them with the decision between the purchase of a new motor or the repair of an existing motor. Because customers depend on motors and systems to be operational and available on demand, they have developed what could be called a partnership with their service providers.

The service providers over time became more innovative, responding to the evolving industry requirements in the area of maintenance and how it affects equipment reliability and safety. These companies provide preventative and predictive motor failure education and direct service, all of which can be queried at the respective company websites. Through these education programs and services, the life of the motor system is extended not only past the warranty, but well into the useful life of the system.

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