The Barn Raiser

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Standard (EPAct Compliant) Vs Premium Efficiency Motors

By: Don Elrod

Electric motor applications and motor-driven systems account for 60 to 70 percent of the total electricity used in the United States. Studies indicate that improving the energy efficiency of motors and motor systems can result in savings of 10% to 25% of all the electricity used in the United States.

On October 24, 1997, the Energy Policy Act of 1992 (EPAct) "Efficiency Requirements for Electric Motors" went into effect. Under EPAct the US government has set (and continues to set) standards and basic test requirements for electric motors manufactured or imported into the US after October 24, 1997. EPAct set new standards for industrial electric motor efficiencies whereby specified electric motors must meet *nominal* full-load efficiency levels. These requirements apply to general purpose, single speed, T-frame, foot-mounted, polyphase, squirrel cage induction motors, NEMA designs A and B, continuous duty, 230/460-volts, 60 hertz. Ratings included are 1 to 200 HP, 3600, 1800 and 1200 rpm in open or closed enclosures. All manufacturers are required by law to comply with the EPAct standards or face penalties for violations. Thus the "standard" motor is an EPAct compliant motor meeting minimum baseline requirements for energy efficiency.

Motor efficiency is defined as watt output divided by watt input, or watt input minus watt losses divided by watt input. The mandated motor efficiencies are obtained by reducing losses. This is accomplished by using better quality steel (high grade silicon steel instead of low-carbon laminated steel), thinner laminations in rotor and stator to reduce eddy current losses, oversized copper conductors instead of aluminum to lower winding resistance, larger winding slot cross-sectional area to accommodate the larger volume of copper, additional slot insulation, longer stator core design for improved power factor, and more efficient fan design to reduce windage losses.

When dealing with EPAct compliant motors we must remember that the nameplate efficiency listed is only the *nominal* efficiency which *is an average value determined by testing a given family or group of motors*. This is not a guarantee that the motor will operate at this efficiency. Care must be taken to obtain each manufacturer's *guaranteed minimum* efficiencies to allow an apples-to-apples comparison between competitive brands. Also we must keep in mind that motors perform best at full load. An underloaded motor is always less efficient than a fully loaded motor.

Most manufacturers have "*energy efficient* "motors which meet EPAct requirements and *"premium efficiency"* motors which exceed the EPAct requirements.

The next step beyond premium efficiency motors are the NEMA design E motors (which should not be confused with the EPAct compliant "*energy efficient"* or "*premium efficiency"* NEMA design A and B motors). These motors have locked-rotor torque values lower than design B motors of the same HP ratings, and significantly higher locked-rotor currents. Replacing an existing design B motor with a design E motor either by accident or due to a desire to increase efficiency could result in the design E motor being unable to start the load. Also, the higher inrush currents could result in nuisance breaker trips. The National Electrical Code has addressed the issue of breaker trips by allowing higher trip settings for instantaneous trip breakers in NEC table 430-152.

"The Barn" built in the 1930's to house Welsh ponies, serves as Mid-South's offices.

Novelty or Reality of Business

By: Mark Culpepper

Companies strive to have an advantage over the competition regardless of what it is that they do, but the ways in which they were quantified came down to three fundamental measurements of: speed, cost and quality. In the 1960s through the 1970s, quality appeared to be the driving force. In the 1980s speed was how manufacturing competed; then in the 1990s cost rose to the top while still claiming to provide both speed and quality of their product. Many different methods have been used to achieve each of these goals, such as Deming management, just-in-time delivery and manufacturing and Six Sigma. Depending on how well and how long a business implements and maintains these tools, you would consider some to be a novelty approach or a business philosophy reality.

Today there is also a fourth measurement and that is environmental friendliness. After the British Petroleum (BP) spill in the Gulf how will a company be viewed? BP's reputation and ability to survive will be put to the test, and the same three measurements of speed, cost and quality will be applied in association with the fourth yardstick: environmental friendliness. How fast did BP respond to the spill to get the oil well capped? How much does this cost the customer, not just at the gas pump, but also in their business and our seas and shore life? What is the quality of the work BP did to cap the oil well and future work that BP undertakes? How do we conduct our business by watching and learning from BP and this environmental disaster?

Environmental friendliness is not just a new trend. In the late seventies, many realized that there were high levels of consumption along with excessive waste of products. This trend was short lived, but this time it doesn't appear to just be a fad. Today new approaches are coming into use to help companies approach product and process design where the environmental aspects are treated as their primary objectives or opportunities rather than simple boundaries. Businesses are emerging to overcome the waste aspects, such as gas landfill management, anaerobic digesters manufacturing and the like. As manufacturing sectors grow and population increases, more waste is produced and more energy is needed and more products are consumed.

Environmental impact due to production and waste generation are now permeating our everyday society and a key factor in how businesses are going to be measured. The consumer is more environmentally conscious, but they will always look at the cost, speed and quality of our work or product to make their purchasing decisions. They will look to see how we approach the **reality** of how we conduct our businesses.

Our ability to design facilities, operations, equipment, products or services with efficiency is critical. Efficiency of: production, energy consumption, space requirements, shipping and inventory control are not just good for the environment but good business. We can always benefit by improving our processes, applying statistical controls, the applications of operations research. Keeping reasonable inventory quantities translates into smaller buildings, less energy expended in heating and cooling, less waste. A key component in reducing waste is to enhance the results or the outputs of the process by reducing or eliminating deviations. Using statistical process control systems, can allow us to coordinate and create measurements to identify off-target processes that have large variations. Minimizing scrap associated with poor quality parts or by working with our supply chain providers who share common quality goals saves money and reduces waste.

Ultimately, the reality of how we conduct our business comes down to if we use the tools available to run efficiently, while producing a quality product or service that gives our consumers a cost benefit that they translate as beneficial to them and view us as a supporter of the environment.