The Energy Independence Security Act of 2007 (EISA) becomes law December 19, 2010. A portion of EISA covers induction motors from 1-500 hp. It's safe to say most end users will be affected.

What does EISA have to do with calculating true motor efficiency? More than you would think. At some point, you'll need to replace a motor covered by EISA. Replacing it with a duplicate that meets the new law would seem to make perfect sense. Not so fast! Before rushing a purchase order through, take time to determine:

- Motor efficiency versus nameplate
- Motor efficiency versus load

To clarify: Yes, you'll improve overall efficiency around two efficiency points by replacing a standard efficient motor with a new EISA premium efficient model. There's much more to be gained, however, by making a few calculations.

Facts
Motor nameplate data doesn't identify precise motor efficiency—*only a range as defined by NEMA*. An induction motor is highly efficient when operating close to its rated torque and speed, but it still has five major components of loss: iron loss, copper loss, frictional loss, windage loss and sound loss. Together, they add up to the total loss of the motor.

Frictional, windage and sound losses are constant, independent of shaft load and typically very small. The major losses are from iron and copper. Iron loss is essentially constant and independent of shaft load, while copper represents a I2R loss, which is shaft-load dependent. Since iron loss is voltage-dependent, it will reduce with reducing voltage.

Most electric motors are designed to run at 50% to 100% of rated load, with maximum efficiency usually near 75%. Thus, a 10 hp motor has an acceptable load range of 5 hp to 10 hp, with peak efficiency at 7.5 hp. Motor efficiency tends to decrease dramatically below about 50% load. The range of good efficiency, however, varies with individual motors and tends to extend over a broader range for larger units. A motor is considered under-loaded when it's in the range where efficiency drops significantly with decreasing load. Throw in a poor motor rewind, and you could have a far-less-efficient motor than the nameplate data indicates.

It is also a well-known fact that motor pumping systems (most pumps are motor-driven) operate at less than 40% efficiency. Clearly, there's an opportunity to save additional energy by reducing the size of the motor.

Calculating
Keep these points in mind when you set out to calculate true motor efficiency:

- Use power, amperage or slip measurements to identify the load imposed on the operating motor.
- Obtain a motor part-load efficiency value consistent with the approximated load from the manufacturer. Or, if direct-read power measurements are available, derive a revised load estimate using both the power measurement at the motor terminals and the part-load efficiency.

Help
If your company tracks energy savings and justifies projects based on documented payback, evaluating your motor performance/load is important. Help is out there. Several commercially available devices will do these calculations for you. If you don't have the resources within your plant to make the calculations, contact a local EASA (Electrical Apparatus Service Association) shop that offers
this service. **UM**

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