Mid-South Engineering Company

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The Mystery of Power Factor

Few terms create as much confusion in the minds of plant personnel as the words “Power Factor”. Poor power factor is often cited to be the culprit for just about every electrical problem countered in a typical industrial facility. While poor power factor is in fact undesirable, a basic discussion of power factor fundamentals should go a long way in dispelling the various myths surrounding this subject.

There are two types of currents in an AC circuit, namely the *power-producing current* – also known as the working current, and *magnetizing current* – also know as wattless, reactive or nonworking current. Equipment such as induction motors, transformer, fluorescent lamps, etc. required both the power–producing and magnetizing currents. On the other hand, loads such as incandescent lamps or resistance heaters require only the power-producing current. Power-producing current is converted into useful work such as turning a pump impeller, making a weld, etc. Magnetizing current on the other hand *creates the flux necessary for making the induction phenomenon possible.* Without the magnetizing current, AC transformers, induction motors would cease to operate, as energy would not flow through the core of a transformer or across the air gap of an induction motor.

The *power-producing current* and *magnetizing current* combine to form the *total current* These currents do not add linearly but vectorially. The unit of measurement for the real power produced by the working current is the *kilowatt* (kW), the unit of measurement for the magnetizing volt-amps produced by the total current (vectorial summation of power-producing and magnetizing currents) it is *kilovolt-amperes* (kVA). Power factor is defined as *real power* (kW) divided by the *apparent power* (kVA). If for instance, if the real power is 800kW and the apparent power is 1000 kVA, the power factor is 800/1000 = 0.8 (alternatively expressed in percent as 80%). The larger this number, the better the power factor.

The utility is usually faced with a dilemma. On the one hand it bills its customers only for the working power or real power (kW), but on the other hand has to also furnish the magnetizing current without which devices such as induction motors, HID fixtures would not operate. To provide power to a typical industrial facility consisting predominantly of induction motors (and operating with the consequent low power factor), the utility is forced to size all its equipment to handle the *total current* rather than only the *working current*. To compensate for this many utilities impose *a low power factor penalty* should the plant power factor fall below a utility defined threshold.

The magnetizing current however does not necessarily have to be delivered by the utility. This current may also be obtained from *power factor correction capacitors.* By locating these capacitors as close to the load as possible, the amount of current delivered by the utility, and consequently the current flowing in the plant distribution transformers, cables, etc. is reduced. This results in improved voltage regulation.

By adding appropriately rated and strategically located capacitors, a typical plant could realize significant savings due to avoidance of power factor penalties and realize extended equipment life due to relieved loading and reduced power losses. Mid-South Engineering has worked extensively with several clients to address these issues over the past several years.

Definitions:

- Owner – A marathon runner who must wear lead shoes and only gets to start after every other runner is halfway to the finish.

- Contractor – A gambler who never gets to shuffle, cut or deal.

- Engineer - The people you blame for anything that goes wrong.

- Project Manager – The conductor of an orchestra in which every musician is in a different union,

“The Barn” built in the 1930’s to house Welsh ponies, serves as Mid-South’s offices.

The Value of Engineering

Webster defines “engineer” as: 1) “to lay out, construct, or manage as an engineer”, or 2) “to guide the course of, to manage”.

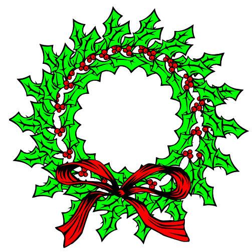
Engineering takes place on every project. Sometimes this occurs on the back of a brown paper bag and sometimes this occurs in an office environment. A plan is put together even though it may not be thought of as engineering. Why plan? The path traveled is always more direct when a plan is put together. It has been said that failure to plan creates emergencies. The plan reveals the materials needed to do the job, the time it will take to implement, the manpower required and predicts the end result. Without a plan, the contractor and owner lack direction and unnecessary work being done is usually the result. Any contractor can be more efficient with a good plan and, therefore , his “hard dollar” contract will be lower. Contingency money is included in a proposal by a contractor to cover unknowns. Therefore, the more a contractor knows about a job, the less contingency money he needs to include. Similarly, time is saved with a good plan on a T&M contract. This results in a lower installed cost.

The money to engineer in the office environment is more than returned to the owner through decreased construction costs as well as through competitive purchasing of equipment and services..

How about information on the installed system for maintaining equipment, ordering spare parts, etc.? On a non engineered project, this information is virtually non-existent, but any kind of organized maintenance plan requires information to support the plan. Downtime is decreased because it does not take as long to troubleshoot and fix a problem when good information is accessible. A contractor has no incentive to maintain and deliver to the owner good information regarding a project. His focus is to get the job done as quickly as possible.

Having a project engineered will decrease the construction time, decrease the overall costs, shorten the time required to pay for the project and leave a record for future savings.

Merry Christmas and A Happy New Year !



Seasons Greetings from all of us!

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