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# Four Critical Considerations for Transformer Replacement



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When power transformers fail, the effects on plant operations can be debilitating. The production gets interrupted, everything grinds to a halt and the effects on the bottom line can be immediate and devastating. This can put a lot of pressure on those in charge of getting operations back up to full-speed.

To make matters worse, since power transformers rarely go down, it is not uncommon for those in charge of purchasing a replacement unit to have little to no experience in the process. In addition, to someone who doesn't purchase many transformers or know much about their design, it may seem as though transformers are more of a commodity item, and hence, can be sourced out to the lowest bid. However, there are a number of considerations that can have long term impacts.

“Quality doesn’t always increase the initial purchase price, but it can greatly reduce long-term costs in a number of important ways,” advises Alan Ober, Chief Engineer at Electric Service Company (ELSCO), an expert with over 40 years of experience in the design and manufacturing of transformers.

Selecting the proper transformer design and construction can actually make a huge difference by extending operating life, reducing overall costs and decreasing the need for future maintenance.

The following considerations can help avoid common pitfalls in the sourcing and installation of transformers.

### **Selecting the right transformer**

To maximize the return on investment on what is arguably the heart of any industrial plant it is important to understand some of the basics. Starting from the top, power transformers are required to step-down the higher voltages delivered by the electric utility company.

For indoor applications, dry-type transformers are by far the most common due in part to the fact that they are air-cooled, so they pose lower risk of problematic leakage, environmental issues and fire. Since they can safely be used inside a facility, dry-type units can be placed right next to the equipment they are powering which can further reduce costs.

In addition, a plant can save additional operational costs by selecting a new unit over a refurbished option. This is due to the higher efficiencies standards enacted by the Department of Energy in 2010 and then further tightened in 2016 on all new transformers.

## **Evaluate winding design**

The way in which the coils are wound around the core of a dry-type transformer greatly affects its robustness and ability to survive “impulses” that can occur from phenomena such as switching surges and lightning strikes.

Two of the most common transformer designs today feature either circular (round-wound) or rectangular windings.

While many transformer manufacturers still offer rectangular windings, because they are less expensive to build, they can develop problematic air traps, hot spots and other problems.

The round coil design, on the other hand, provides significant ongoing operational and cost-saving advantages. Round-wound transformers stay cooler, run quieter, and present less risk of short circuit when coupled with a sheet wound secondary.

## **Consider the material**

In addition to the design, the material used for the windings and insulation can greatly affect performance and prevent disastrous emergencies from occurring during the unit’s operating life.

For transformer windings, the most common materials used are copper and aluminum. While copper does have a higher upfront cost, it more than makes up for that by outperforming and outlasting aluminum.

The selection of proper insulation also plays a major part in ensuring transformer reliability. Temperatures can reach 200 degrees C in a dry-type transformer on a daily basis; hence skimping on insulation can lead to disastrous consequences.

Therefore, higher-quality insulation, such as DuPont Nomex® flame resistant meta-aramid insulation, should strongly be considered. This is the same insulation used in the safety gear worn by race car drivers, fire departments, military applications, as well as in numerous electrical applications.

### **Investigate a “drop-in” solution**

Finally, a factor that is often overlooked: The removal of the old transformer and installation of the new one can be time-consuming and costly if not properly addressed beforehand. This is particularly important when there are existing enclosures with dimensional/clearance constraints.

Throughout his extensive career, Ober has seen a number of situations where it has taken riggers days to complete the removal of transformers, and then several more days for the new unit to be installed and hooked up to the switchgear and bus work. Custom bus work for dry-type units may be part of the solution.

“The transformer manufacturer should be consulted and needs to be capable of slightly modifying the transformer – either new or remanufactured – so that it can be ‘dropped-in’ or mated with the existing transformer infrastructure, meeting UL, IEEE standards plus all required clearances, within a few hours,” says Ober.

He adds that consulting suppliers on a user’s specific application, present and anticipated power supply needs, and getting an informed evaluation of the options available, can lead to the effective selection of a transformer that will pay substantial dividends in performance and greatly reduce the total cost of ownership.

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