Tech Tips

Power Supplies: Time to Replace?

SUMMARY

Power supplies are often the weakest point of an otherwise highly reliable process control system. While the typical operating life of process control equipment can often exceed 25 years, we recommend considering replacement of PLC/PAC power supplies beginning at about 10 years of operation depending on the temperature and voltage of the operating environment. This recommendation is based on well-established science and our many years of experience with our customers.

The Science

Almost all DC power supplies employ some kind of energy storage on-board to smooth out voltage ripple on the outputs while in operation. In addition, PLC power supplies typically include an extraordinary amount of energy storage to allow the system to ride through short brownouts, and to allow the system time to do a safe shutdown in the event of power loss. For both technical and cost reasons, most manufacturers use electrolytic capacitors to provide the needed energy storage. This type of capacitor also offers better electrical performance and more energy storage per unit volume. Power supplies from both CTI and Siemens/TI employ electrolytic capacitors for energy storage.

Why should you consider replacement of power supplies that use electrolytic capacitors after 10 years?

Replace Power Supplies > 10 Years Old to Ensure Seamless Operation of Process Control Systems

CTI's 2500 Series® power supplies are direct replacements for TI/Siemens 505® Series power supplies (and can be adapted for TI Series 500 as well) providing 55 to 100 watts of VDC or VAC power. They are fully backwards compatible and fit in standard-sized or Compact-sized racks.

- **Replace power supplies every ten years of operation.**
- **Avoid power brownouts and resulting nuisance shutdowns**
- **Ensure reliable and seamless operation of your process control system**
- **Extend the life of your process control system**

An electrolytic capacitor uses an electrolyte, an ionic conducting liquid, as one of its plates, in order to achieve a larger capacitance per unit volume than other types. Unfortunately, in all such capacitors the electrolyte degrades

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over time due to evaporation of water and resulting change in conductance. When the conductance changes outside the design parameters of the circuit, the operation of the product is compromised.

What things affect the life of electrolytic capacitors?

The primary factors are temperature and voltage. A power supply operated near or above its rated temperature will have a shorter capacitor life. A power supply exposed to frequent overvoltage transients will have a shorter life. In addition, capacitors "on the shelf" (i.e., power supplies in storage) have an accelerated degradation compared to power supplies operated at normal ratings because corrosion processes can weaken the oxide layer, which may lead to a higher leakage current. A secondary factor is operating the capacitor with high ripple currents resulting from extended operation of the power supply at or beyond its rated current.

What are symptoms of failing capacitors?

- Lower hold-up time which results in nuisance shutdowns because of no brownout resistance.
- Increased ripple in power supply output which can result in unpredictable operation of modules on the backplane.

Our Experience

Customers who employ a proactive replacement strategy enjoy far fewer nuisance shutdowns due to power supply problems. When our technical support team gets a call about unexplained PLC systems issues, one of the first things we look for is one or more failing power supplies.

Why Should I Replace My Power Supplies That Are Currently Operating without Incident?

Two reasons: First, the biggest problem associated with reduced energy storage is reduced hold up time. You'll never know that the energy storage of your power supply is degraded until you have a brownout and a resulting shutdown of your PLC system. Also, if the energy storage is not in specification, the power supply will not provide the correct timing of the shutdown control signal to the PLC. Result: when power is restored, the PLC will not restart automatically but instead will come up with a fatal error.

Second, the voltage ripple on the power supply will increase over time and, at some point, can cause a problem with operation of the PLC system. For a more in-depth discussion of the electrolytic capacitor reliability and lifespan, see "Reliability," "Lifetime," and "Performance after storage" in this Wikipedia article: http://en.wikipedia.org/wiki/Electrolytic_capacitor

Please do not hesitate to contact us if we can be of any assistance. We appreciate your business.

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