CONTROL TECHNOLOGY INC.

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Dear CTI Customer,

Many 2500 Series® users have recently expressed concerns about aging CTI and Siemens® power supplies (505-6660-A, 505-6660-B, 505-6663, 2512, 2512-A, 2515, 2513, 2510) in their facilities, and have asked if CTI has recommendations regarding power supply replacement.

We recommend considering replacement of PLC power supplies beginning at about 10 years of operation. This might seem like an unusual recommendation given the typical operating life of modern industrial electronic equipment. However, it is founded in well-understood science and in many years of experience with our customers.

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 which use electrolytic capacitors after 10 years? Electrolytic capacitors use an electrolyte, an ionic conducting liquid, as one of its plates, to achieve a larger capacitance per unit volume than other types. Unfortunately, in all such capacitors the electrolyte degrades 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 life on the capacitors. A power supply exposed to frequent overvoltage transients will have a shorter life. In addition, capacitors “on the shelf” (ie power supply in storage) have an accelerated degradation compared to power supplies operated at normal ratings. A secondary factor is operating the capacitor with high ripple currents – 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.

My power supplies are operating without incident. Why should I replace them?
Two reasons. First, the biggest problem associated with reduced energy storage is reduced holdup 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, over time the voltage ripple on the power supply will increase, and at some point it will cause a problem with operation of the PLC system. For a more in-depth discussion of electrolytic capacitor reliability, see “Reliability and Length of Life” in this Wikipedia article: http://en.wikipedia.org/wiki/Electrolytic_capacitor

I hope this explanation is helpful to understand the reason for our recommendation for replacement of power supplies. Experience has shown that customers who employ this kind of replacement strategy enjoy far fewer nuisance shutdowns due to power supply problems. In most plants, the increased reliability more than offsets the cost of this replacement. If you have any questions please do not hesitate to contact us.

Regards,

Robert Peck
Senior Vice President
Control Technology Inc.