

Delta vs Wye Connected Capacitors



"Power Factor & Power Quality Specialists"

240 Huckins Street, PO Box 24

Goderich, Ontario, N7A 3Y5

Delta Connected Capacitors Vs Wye Connected Capacitors (On Motors and used in Capacitor Banks)

Installing a Wye connected capacitor to motors is not appropriate application of the capacitor and can potentially cause a catastrophic failure to not only the capacitor but to the motor. The main reason for this is because they are ungrounded and thus can present a potential difference on each phase of the capacitor which in turn contributes to the over-all deterioration of the capacitor and the attached motor.

As can be seen in fig.1 below, the failure of any one cell of a Wye connected capacitor presents an unbalanced load to the motor. This will effectively destroy the motor due to unbalanced voltage, temperatures.

Example: If you have a 100HP motor and an unbalance of 5%, this will cause a power loss of 25%. ($100\text{HP} - 25\% = 75\text{HP}$). If the motor was loaded to 85%, the motor now becomes overloaded. The motor would run 113.5% overloaded, therefore overheated and will eventually burn out.

Unprotected Wye connected capacitors should not be used for Power Factor correction for similar reasons. In fact, the unbalance protection required for this type of application is more costly than the capacitors themselves and therefore not generally included with Wye connected capacitors.

Wye connected capacitors also do not circulate harmonics and thus are much more vulnerable to failure due to harmonics.

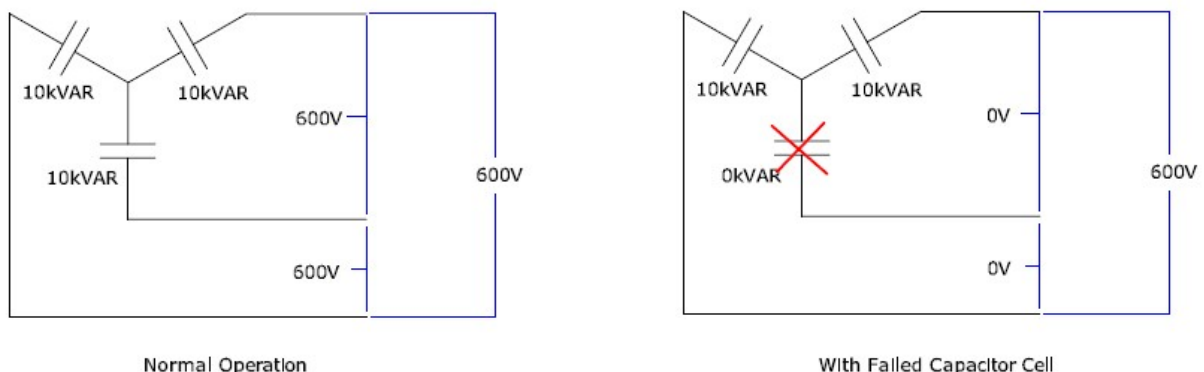


Fig.1 - The total capacitance for the example above with a failed cell would be 5kVAR

Delta connected three phase capacitors are more friendly to the electrical environment. They not only provides capacitance to each phase but also provides no voltage unbalances (harmonics).

If a capacitor cell should fail for any reason in one phase, we are going from a closed delta to an open delta configuration and in this instance the voltages on each phase stays the same (see fig.2 below). Failure of a capacitor cell would only mean a drop in the kVAR on the circuit. In other words, a 30kVAR delta connected three phase capacitor with a failed cell would provide 20kVAR to the electrical system instead of 30kVAR.

Delta connected capacitors unlike the Wye connected capacitors are able to circulate harmonics currents within the delta circuit and by doing so help to reduce the harmonics on the electrical system.

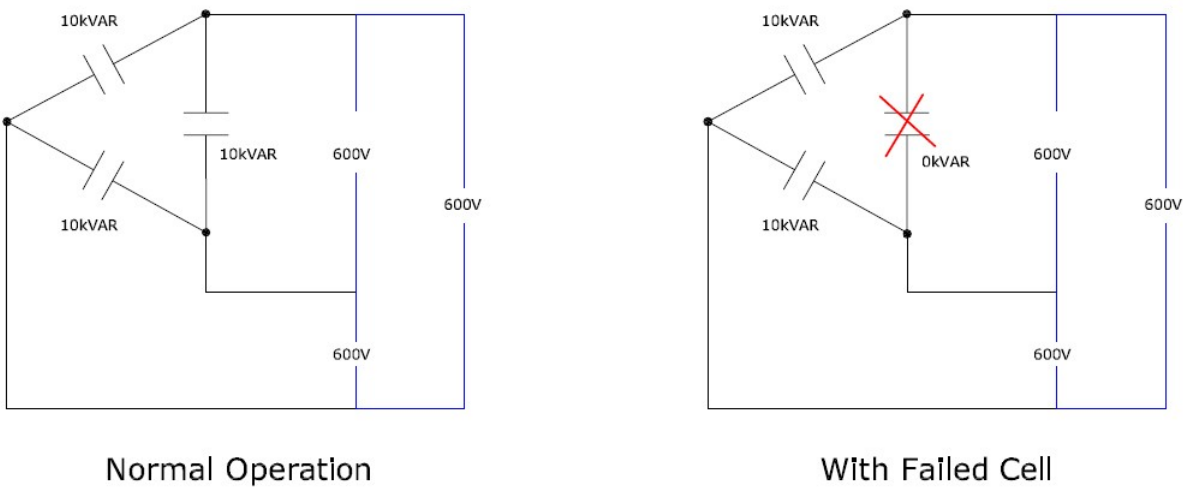


Fig.2 - The total capacitance for the example above with a failed cell would be 20kVAR