Pump ED 101

Why Wye ? Why Delta ? – Part 2 Mutant Ninja Deltas

Joe Evans, Ph.D http://www.PumpEd101.com

The secondary's we reviewed last month are typical three phase configurations found in pump applications. There are, however, several Delta mutants that can be problematic and the result will almost always be reduced motor life.

A mutant, that is becoming more common is the Center Tapped Delta. As seen in Figure 1, this configuration attaches a grounded neutral to the center of one of the phase windings. The phases on either side of the center tap provide 120V single phase but the phase on the opposite side produces 208V. If you accidentally connect a control circuit to this leg, expect to see some smoke! Also, unlike the Wye secondary, there are only two connections available for single phase loads. If too many loads are connected to one or both of these connections, voltage unbalance can occur in the three phase circuit. These transformers will provide balanced power as long as they are sized properly and single phase loads are accounted for during sizing.

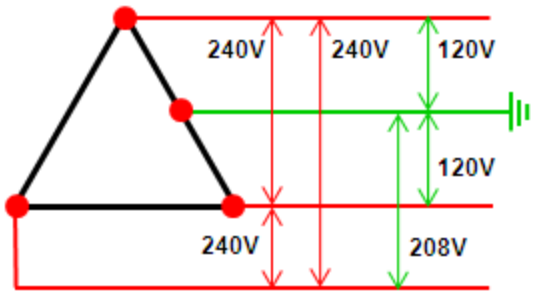
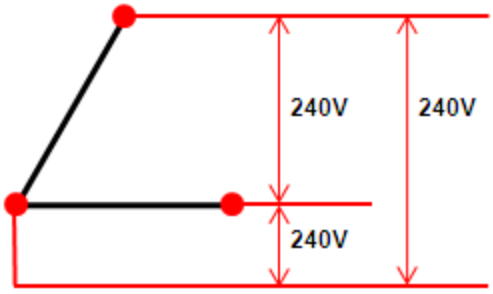


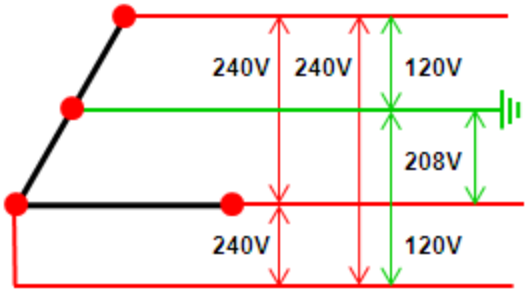
Figure 2 is that of an Open Delta secondary. Open Delta systems employ two, single phase transformers to produce three phase power but, provide just 58% of the power produced by three, single phase transformers. They are used by the electric utility when only two phases are available and are often seen in rural areas. Although the phase to phase voltage is the same as the standard Delta, they are prone to unbalanced voltage among the phases. A small voltage unbalance of just 2% can result in a current unbalance of 12% to 16%. When the voltage supplying a motor phase winding is reduced, current and temperature will increase and the result is reduced insulation life.



A VFD can be used to balance the voltage in installations prone to unbalance but, the drive must be sized to accommodate the increased current. A DC choke may also be required to mitigate any harmonics that may arise due to the unbalanced

impedance of the phase windings.

The worse case example of mutant Delta transformers is the Center Tapped, Open Delta shown in Figure 3. This design combines all of the weaknesses of the previous mutants. Not only is it subject to voltage unbalance due to the use of just two transformers, it also increases the probability of unbalance by providing two single phase connections on a single transformer. If this design powers a three phase motor and its single phase control circuit, it is always best to disconnect all other single phase loads.



Use caution when utilizing these mutants for three phase pumps. Measure and calculate the Open Delta voltage unbalance frequently and consider installation of a VFD if unbalance is greater than 1% in the three phase circuit. Make sure the single phase loads are balanced on the Center Tapped Delta and that unbalance in the three phase connection is 1% or less. If possible, avoid single phase loads on Center Tapped Open Delta transformers if the three phase load is 75% or more of the total capacity. If the two transformers are different sizes, the larger one should contain the center tap.

Joe Evans is responsible for customer and employee education at PumpTech Inc, a pump & packaged systems manufacturer & distributor with branches throughout the Pacific Northwest. He can be reached via his website www.PumpEd101.com. If there are topics that you would like to see discussed in future columns, drop him an email.