Application Note

Application Limitations with Buck-Boost Transformers

1. **A Buck–Boost transformer cannot be used to develop a three phase, four wire wye circuit from a three phase, three wire delta circuit.**

   A delta to wye connection does not supply enough current carrying capability to provide for unbalanced currents flowing in the neutral wire of the four wire circuit. The neutral created is not stable and under load will not deliver desired line to neutral voltages. This connection would also be in violation of the National Electric Code, Article 210-9.

2. **Buck–Boost transformers cannot be used in a closed delta connection.**

   A closed delta requires more KVA capacity than a wye or an open delta connection, plus phase shifting comes into play on the output side.

3. **Buck–Boost transformers should not be used to correct for voltage drop on a long circuit run where the load fluctuates.**

   Voltage drop varies with the load and buck-boost transformers are connected for a specific voltage change. If a buck-boost transformer was used to correct voltage drop during peak loading conditions, high voltages may result under light load conditions. This could be equally detrimental to the load and possibly pose safety hazards.

4. **Buck–Boost transformers cannot be used to create a 240/120 Volt, single phase service from a 208Y/120 Volt three phase supply.**

   Two problems are created if you were to try this:

   A. Two neutrals would exist on the same circuit. Since neutrals must be grounded according to the National Electric Code, a short circuit would be created.

   B. Unbalanced line to output neutral voltages would be created; one line would read 120 Volts, the other 130+ Volts.

What is a Buck-Boost transformer and why is it used?

Isolation transformers have separate primary and secondary windings, electrically insulated and isolated from one another. With a relatively high voltage primary (typically 120, 240 or 480 Volts) and a relatively low voltage secondary (typically 12, 16, 24, 32 or 48 Volts), buck-boost transformers are designed to be field connected as autotransformers. These are transformers with one continuous winding, a portion of which is jointly shared between the input and the output. No electrical isolation is present in an autotransformer.

Buck-Boost transformers have two major uses:

1. When field connected as an autotransformer, they can be used to **Buck** (lower) or **Boost** (raise) available line voltage in the range of 5 to 27% and at a KVA rating many times that listed on the transformer nameplate.

2. When left as an isolation transformer, they can be used to supply power to low voltage circuits at the nameplate rating listed.

The importance of altering available line voltage.

Electrical equipment is designed to operate at maximum efficiency at a specific standard supply voltage. Your voltage may not be at the standard supply voltage level. Causes can be proximity to a large utility transformer, losses in the line voltage due to loads on that circuit, or a difference between the standard supply voltage available and the standard supply voltage needed to run the equipment.

Normally the problem is having low voltage available. Low voltage on a circuit, even as little as 5% lower can cause a decrease in incandescent light output, and a decrease in resistive heat output. With motors low voltage can cause a decrease in motor torque, an increase in motor amperage requirements, an increase in motor temperature and decrease in motor life expectancy.