

The Cost Effectiveness of Using Buck-Boost Transformers

Executive Summary

Buck-boost transformers are power protection devices designed to protect electric equipment, such as motors and industrial air conditioners, from damage due to improper line voltage. Buck-boost transformers are ideal and economical solutions where the line voltage is consistently below or above the rated load voltage. Their main function is to adjust a line voltage by a small amount (normally 5% to 27%) to match the load voltage. They are commonly used in applications that require boosting of line voltage from 208 V to 230 V and in applications where the nominal voltage is above or below 120 V.

Buck-Boost Transformers can be used as Distribution and Auto Transformers

A buck-boost transformer is shipped as a distribution transformer, conversely it can be connected as an auto transformer in numerous ways depending on the voltage and kVA load. Moreover, the transformer connection depends on the supply voltage, load voltage, load kVA and frequency. Buck-boost transformers are used as distribution transformers for low voltage applications such as 12, 16, 24, 32 and 48 V as output voltage. Examples of a low voltage application include landscape or halogen lighting.

A buck-boost transformer becomes an auto transformer when the primary and secondary windings are connected as per instruction. In such a condition, only the secondary windings are transforming voltage and current. The majority of the kVA load passes directly from the supply to the load.

Cost Effectiveness Illustrations

To illustrate the savings, we can use the example of a tanning salon and the voltage required for the tanning bed. The service to the building is 208 Y/120 Vac and many tanning beds are designed for 230 V. The load amp rating is 25 Amps. The secondary low voltage winding is connected in series with the primary winding.

Some larger tanning beds require 3 phase power, so using two transformers in the same example above will save the customer approximately \$1200.00 and a lot of floor space. Multiply this by the number of beds in a single location and the savings can be substantial. Because the buck-boost transformers are smaller and



Buck-Boost Transformer

- 208 V is boosted to 229 V (by 21 V) for tanning bed voltage
- 21 V boost * 25 Amps = 525 VA minimum requirement
- 750 VA buck-boost transformer

Distribution Transformer

- 230 V output is supplied to tanning bed
- 230 V * 25 Amps = 5,725 VA minimum requirement
- 7,500 VA distribution transformer

\$600 cost savings using a 750 VA buck-boost transformer over a 7,500 VA distribution transformer.

less costly, they are more available on a distributor's shelf. Customers normally find out at the last minute that the required equipment voltage is different and need a quick inexpensive solution. In addition to acquisition costs being lower, the unit is smaller and therefore easier and less costly to install.

Buck-Boost Selection

The following steps will help you choose an appropriate buck-boost transformer for a given application:

Single Phase or Three Phase

Find out whether the application uses single phase or three phase load. Single phase line should match single phase load whereas three phase line should match three phase load. (Note: Three phase applications may require two or three transformers whereas the single phase application may require only one transformer.)

Input Line and Load Voltages

Find out the input line voltage at the point of connection using a true RMS voltmeter. Also, find out the load voltage required for the equipment or device to operate. It is generally found on the nameplate of the equipment under load.

Frequency

Ensure that the line frequency and the load frequency of the transformer are same.

Load kVA or Load Amperage

Determine the load kVA or load amperage. This is found on the nameplate of the load equipment. If there are multiple equipments used, load kVA or load Amps of individual equipments must be added to determine the total load kVA or load amperage to be supplied by the transformer.

Benefits and Features

- Low Cost
- Compact Size
- Light Weight
- Highly Efficient
- More Economical than Equivalent Distribution Transformer
- Can handle loads up to 20 times the nameplate rating when connected as an auto transformer
- Indoor or Outdoor Service
- UL Certified

Limitations

There are a few limitations that are very common among most of the commercially available buck-boost transformers:

- Cannot be used to develop a three phase, four wire wye circuit from a three phase, three wire delta circuit
- Cannot be used in a closed delta connection
- Should not be used to correct for voltage drop on a long circuit run where the load demand fluctuates
- Cannot be used to create a 240/120 V, single phase service from a 208 Y/120 V three phase supply

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