Shop "Tech Talk" September 2007

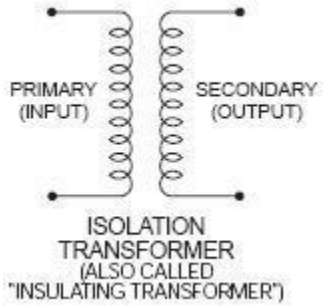
Q. I recently spoke to one of your inside guys about a problem I was having with low voltage at one of .my panels and he said we could solve the problem using a Boost-Buck Transformer. Tell me more about this type of device

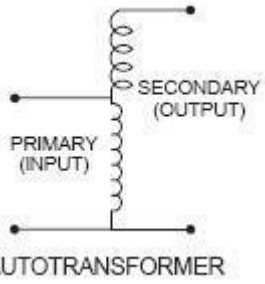
A. I am glad you asked. These guys can really help when you face a high or low voltage situation at . one of your machines

Buck– Boost Transformers are single phase, four winding isolation transformers designed for 2 purposes:

1. **The first purpose is as a low voltage Isolation Transformer for use on 12,16,24,36, or 48 volt circuits. When used as low voltage transformers Buck-Boost transformers have capacities of 50 VA to 5 kVA**
2. **Their second and more important use is as a Book-Boost transformer. These transformers are used to Buck (lower) or Boost (increase) line voltage to match the required load voltage**

Buck-Boost connections result when a lead (s) from the Primary Winding is interconnected to a lead (s) from the Secondary Winding. This interconnection modifies the transformer from an Isolation Transformer into an Autotransformer because the Primary and Secondary Windings are no longer isolated from each other.





The most common voltage change needed is from 208v to 230v. Let us follow an example of figuring this to see how we do it.
Let's say we have a 208v single phase supply and we need to Boost it to 230v @ 40Amps, single phase.
If we select a Boost Buck Transformer with a Primary Voltage of 120x240 and a Secondary Voltage of 12/24v and a 1 kVA capacity, then
We would hook the Primary up for 240v and the Secondary for 24v.
At 1 kVA what would the current be on the 24v side ? It would be 1 x 1000 / 24 = 41.67 Amps
Since: Single Phase kVA = (Load Voltage x Load Amps) / 1000,
so Load Amps = $\frac{\text{Single Phase kVA x 1000}}{\text{Load Voltage}} = \frac{1 \text{ x } 1000}{24} = 41.67$ Amps

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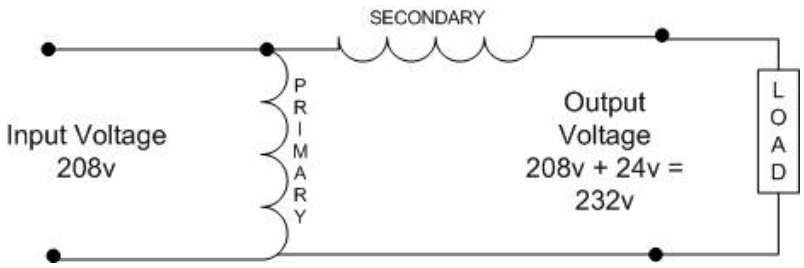
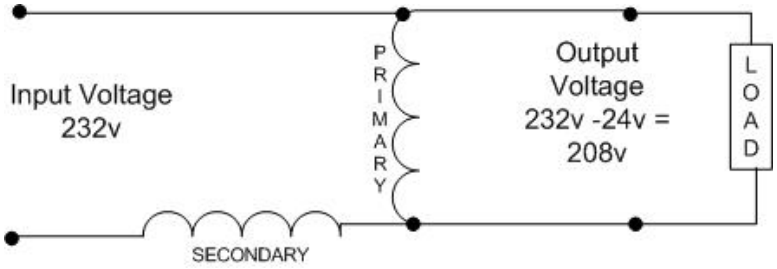
So this selected Boost Buck Transformer of 1 kVA capacity could in fact supply a 40 Amp load. From the Autotransformer drawing on the preceding page you can see that the load current travels only through the secondary winding. If I redraw this diagram differently, as below, this should be more apparent



If we want to subtract , say 24v, from an input of 232v to arrive at 208v then the drawing becomes as below



The load current always moves through the low voltage windings of the Buck-Boost Transformer so we should always select a Transformer whose low voltage winding can carry the stated load current.

In the examples above we have added and subtracted 24v from our supply voltage. We could of course do the same for 6v, 12v, 16v, 32 and 48v when needed.
It is also possible to add 120v to the primary voltage if we have say a 240v to 120v Transformer we can add the 120v to the 240v to get 360v. Likewise we can add 120v to 480v to give us 600v if we have a Transformer 480v/120v.

I have chosen to explain the simple case of a single phase Boost-Buck but we can also do the same thing with three phase Buck– Boost Transformers. In these cases we can use 2 or 3 transformers. The number of Transformers to be used in a three phase installation depends on the number of wires in the supply line. If the three phase supply is 4 wire Y ,use 3 Buck-Boost Transformers. If the 3 phase supply is 3 wire Y (neutral not available) use 2 Buck-Boost Transformers.

The selection of the correct Buck-Boost Transformer (s) to use is greatly facilitated by the selection charts offered by the Transformer Manufacturer.