http://waterheatertimer.org/How-to-identify-transformer-wiring.html

http://waterheatertimer.org/How-to-wire-3-phase-electric.html

MICRON

Training Guide

Effective Date:
August 1, 2011

GENERAL PURPOSE:

DEFINITION:

Transformers are AC to AC devices. You cannot transform DC
Enclosed Power Transformers can be either single or three phase. They are also called "LVGPs" or "Dry Types". These are always in a potted or ventilated enclosure.

TERMS:

Sinusoidial: Or sine wave. A mathmatical function that describes a smooth repetitive oscillation. The phase is defined where in the cycle the oscillation begins. See depiction below.

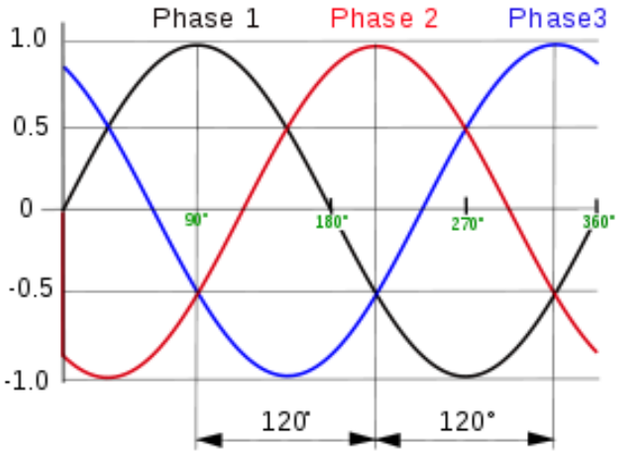
Neutral: The neutral is the point on a three phase system where each of the phase voltage legs are equal in magnetude and equally spaced in phase. It is the mathmatical center of an equilateral triangle formed by the three phase points. Because of this, the phase-to-phase voltage is √3 (1.732) times the phase-to-neutral voltage.

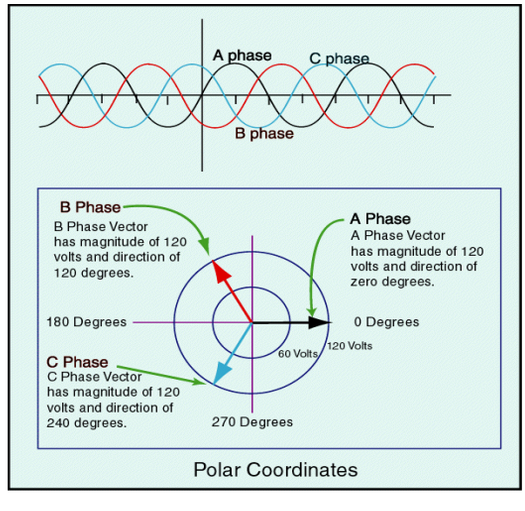
Example: 120V phase-to-neutral X 1.732 = 208V phase-to-phase. G015K5QH2A04 has a secondary of 208Y/120

The neutral allows the balancing of single phase loads between any/all of the individual three phase legs and the neutral point while still allowing for normal three phase loading. The neutral is also a grounded conductor which typically ties to the system's earth ground at the breaker panel.

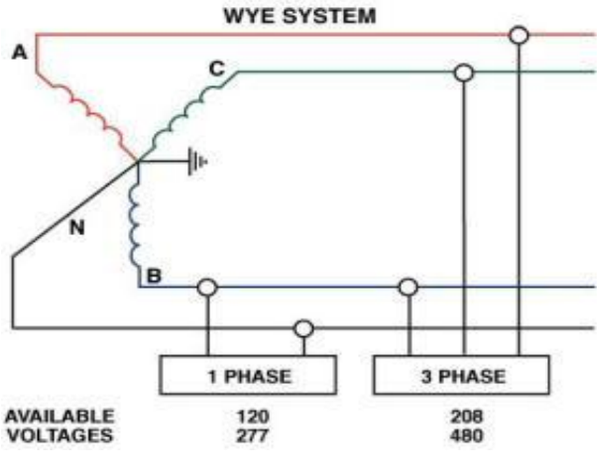
Phase-to-Phase: Voltage measured between any two "corners" of a Delta connection or between any two "legs" of a Wye connection.

Three Phase: The common method of electrical power generation and transmission. The generator at the power station converts mechanical power into a set of alternating electrical currents, one from each electromagnetic coil or winding of the generator. The currents are sinusoidial functions of time, all at the same frequency but with different phases. The phases are equally spaced and separated from each other by 120 degrees. 3 cycles 120° apart = 360° or one revolution of the generator. It is the revolving magnetic field caused by the three phases that causes an elecric motor to start turning.
See depiction below.

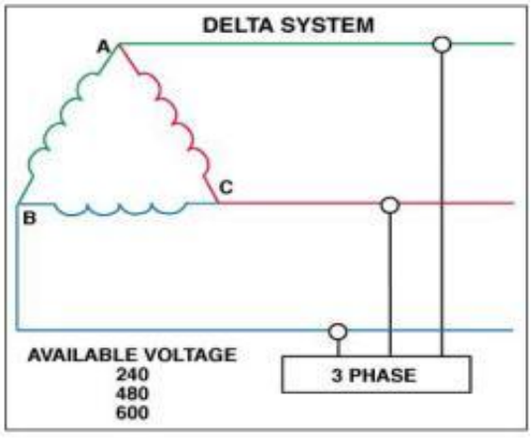




Wye: Also called Star. All phase windings are connected at a common point (resembles a star) which is typically where a fourth wire (neutral) and a ground is connected. Three phase loads are connected to the "A", "B", "C" (line-to-line) terminations while single phase loads are typically connected line-to-neutral. Unless they are light, connecting single phase loads line-to-line unevenly loads two windings, may unbalar the phases and derates the transformer more than connecting line-to-neutral.



Delta: A common three-wire, three phase system in which the voltage potential between each pair of wires is the actual transformer voltage. Although typically ungrounded, a "grounded reference" can be developed by center-tapping the "A"-"C" winding (see high leg) allowing for more load flexibility.



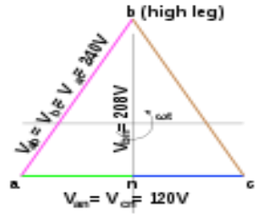
Single Phase: Single phase power is produced from a three phase source by connecting either between a phase and neutral or connecting phase-to-phase. Interestingly, single phase cannot produce the necessary revolving magnetic field to start an electric motor turning. All single phase motors need additional circuits for starting

Buck-Boost: Refers to a transformer used to make slight (typically <48 volts) adjustment to line voltage. Because the adjusting transformer only carries the current related to the actual % change made, it is typically much smaller that would normally be required for the entire load. Adjustments can be made to both single and three phase systems. The transformer(s) are wired with one leg of the line power running through either the adjusting transformer primary and secondary or reverse depending on whether the adjustment is up (boost) or down (buck). Almost any transformer can be used for this application. Adjustments up to 120 volts are possible when using transformers with higher secondaries than the typical 12/24, 16/32 and 24/48 found in buck-boost transformers.

Remember : Buck boost transformers can also be used in a conventional way to provide low voltage output beyond the VA range of typical CPTs.

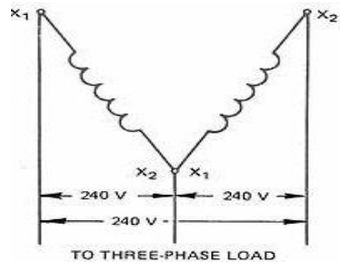
High Leg: Also called Wild Leg or Stinger. On a three phase Delta system, a mid-point or center tap of the "A"to "C" phase winding is labeled "N" and becomes a grounded reference (sometimes referenced as a neutral). Voltage measurements between possible connection points are as follows:

Phase-to-Phase	Phase-to-Neutral
"A"-"B" = 240V	"A"-"N" = 120V
"B"-"C" = 240V	"B"-"N" = 208V
"C"-"A" = 240V	"C"-"N" = 120V



High leg Delta systems provide increased voltage flexibility over similar Wye systems because, in addition to a ground and 120 Volt single phase, they offer a higher (240 volt) three phase connection.

Open Delta: A three phase transformer bank using two transformers. Although one side of the Delta is physically not there, an electrical measurement is possible across the missing side (see example below). It is not as efficient as a three transformer system and is normally reserved for smaller loads. Many three phase buck-boost applications are wired in Open Delta configuration.



Shielding: Also called a Faraday Shield. A grounded conductor placed between primary and secondary windings to mitigate line-to-line or line-to-ground noise.

FCAN/FCBN: Anacronym for Full Capacity Above Normal and Full Capacity Below Normal. These are taps on the primary side to adjust for slightly low or high line voltage. Expressed in % of adjustment. Example: FCAN: 2 @ +2.5% / FCBN; 4 @ -2.5%.

Drive Isolation Transformer: A transformer designed to isolate the motor from the line and handle the added loads imposed by harmonic feedback created by the drive. Typically they are sized to the horsepower rating of the motor which relate to non-standard Kva sizes such as 11, 27, 51, 63. Normally mentionin an odd-ball Kva is a tip that the customer is looking for a drive isolation transformer.

Lighting Tap: Typically a 120V single-phase secondary tap which is limited to 5% of the transformer rating.

SELECTION:

You need to find out some of the information in *ITALICS* in order to properly select a transformer.

1 ***Try to get a competitive P/N Quantity and if possible competitive price***

If you get this information you will likely not need step two.

Primary competitors:
Sq-D
Acme Transformer
Sola/Hevi-Duty
Hammond Power Solutions
GE
Cutler-Hammer
The quickest way to cross a part number is to look it up on-line.

2 ***If competitive P/N not available you will need to get the following information:***

a. ***Single Phase or Three Phase***

b. ***Primary Voltage (input)***

Single Phase primaries are typically expressed as: 120V, 208V, 230V, 277V, 480V
>>>>>The voltage potential measured between the two wires you intend to connect to the transformer determines the primary voltage taps chosen.
Three Phase primaries are typically expressed as: 208 Delta, 240 Delta, 480 Delta

c. ***Secondary Voltage (output)***

Single Phase secondaries are typically expressed as: 120V or 240V and 120V/240V
Three Phase secondaries are typically expressed as: 208 Wye/120, 240 Delta, 480 Delta

d. ***Load Rating***

Volt-Amps (VA)
VA (Volts X Amps) EXAMPLE: 50VA, 500VA, 1500VA
Kva (Volts X Amps)X1000 EXAMPLE: .050Kva, .500Kva, 1.5Kva
SINGLE PHASE EXAMPLE: If amp load and voltage is known then Volts X Amps = VA
If VA and Volts are known then VA / Volts = Amps
THREE PHASE EXAMPLE: If amp load and voltage is known then (Volts X Amps) X 1.732) = VA
If VA and Volts are known then (VA/Volts)/1.732) = Amps.

e. ***Sizing the transformer***

There are a number of places to quickly look this up.
1. Single Phase or Three Phase Selection Guide in the LVGP catalog
3. Horsepower and/or Amp ratings in the LVGP catalog
Just remember:
Add all of the full load amps of the system together then knowing the operating voltage will allow the selection of the minimum sized suitable Kva
The Kva values in the tables are finite. If your calculated value exceeds a listed value select the <u>next largest</u> Kva.

3 ***Provide wiring information from catalog pages 13 - 24.***

4 ***Provide frame drawings from "N" Drive listing.***

5 ***If the request is for a ventilated unit ask if waether shields or rodent screens are necessary.***

BUCK-BOOST

1 ***Is it single phase or three phase?***

2 ***What is the line voltage?***

3 ***What voltage does the customer want?***

4 ***What is the required load in amps or Kva?***

Look in the LVGP catalog pages 27-33 and choose the unit that meets the needs.
Single phase applications use one unit, three phase either two or three.
REMEMBER: Ask for engineering assistance if you can't find the solution within the buck-boost pages.

5 ***Scan and send the correct wiring diagram found on page 34.***

REMEMBER: Buck-boost transformers can also provide solutions for low voltage (12V-48V) high Kva (1Kva-7.5Kva) loads.

COMMON QUESTIONS

I need a transformer for a 1.5HP motor. Can you help me choose a transformer?

1. Is the motor single phase or three phase?
Ask for the motor voltage.
Ask for the line voltage.
Single Phase: Refer to page 7 of the LVGP catalog and choose the suggested minimum Kva value. In this case 2.4Kva. Once you know the Kva value and required voltages, the proper transformer can be chosen from the catalog pages.
If the voltages and required amps are given, the proper transformer can be chosen using the chart at the bottom of page 7. Please note the footnote on this chart regarding service factor (duty cycle).
Alternately, given the motor volts and full load amp draw the Kva can be calculated by multiplying Volts X Amps and dividing by 1000
Example: V=208, A=11 (208 X 11)/1000 = 2.29 minimum Kva (catalog equivalent 3Kva)
Three Phase: Refer to page 8 of ther LVGP catalog and choose the suggested minimum Kva value. In this case 2.1Kva. Once you know the Kva value and required voltages, the proper transformer can be chosen from the catalog pages.
If the voltages and required amps are given, the proper transformer can be chosen using the chart at the bottom of page 8. Please note the footnote on this chart regarding service factor (duty cycle).
Alternately, given the motor volts and full load amp draw the Kva can be calculated by multiplying Volts X Amps and the product times 1.732 then dividing by 1000
Example: V=208, A=5.7 ((208 X 5.7) X 1.732)/1000 = 2.05 minimum Kva (catalog equivalent 3Kva)
Remember that the calculation yield the absolute minimum Kva so round up.

Does the transformer have taps?

Many of Micron's LVGP products allow for slight adjustment of incoming primary voltage.
Refer to the catalog to see if the inquired producthas FCAN and/or FCBN taps.

Can the transformer be reverse connected?

Single Phase: typically, above 3Kva, a transformer can be wired either as a step-down or step-up device. Windings on transformers under 5Kva are typically "compensated" to provide label voltage at full rated load. The compensation value can be as much as 13% on a 50Va and lessens as the VA increases.

EXAMPLE: putting 120V into the secondary of a G050A1KF1A01 might yield 418V from the 480V primary at no load and 355V at full load.

EXAMPLE: putting 120V into the secondary of a G003K1KF7A03 would yield 475V from the 480V priimary at no load and 470V at full load.

Remember to remind the customer when asked about reverse connecting.
Three Phase: typically the normal primary voltage is a Delta configuration. A three-phase transformer can be reverse connected as long as the transformer secondary had a Delta output. Due to possible instability issues Wye primaries are not recommended.

Can I run a 60Hz transformer at 50Hz?

Hertz is a measure of electrical frequency. The nameplate frequency can be run at higher, but not lower than nameplate frequency. This includes buck-boost transformers which are all 60Hz.

Is the transformer weatherproof?

Encapsulated designs meet NEMA 3R and can be mounted outdoors as long as they are oriented upright.
Ventilated designs meet NEMA 3R with installed weathershields.

What is NEMA 3R?

Provides a degree of protection of internal components against falling dirt, undamaged by the external formation of ice and harmful effects due to the ingress of rain, sleet or snow.

NOTES