APPLICATION NOTE 101

Interconnection Design Requirements

PURPOSE & SCOPE

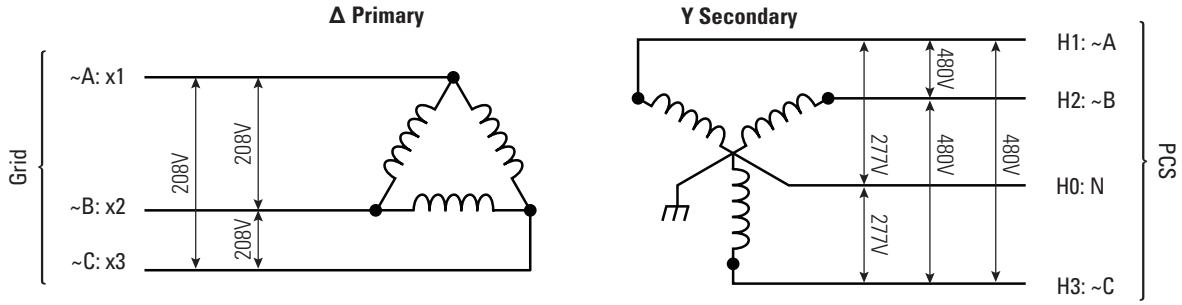
Ideal Power Conversion Systems (PCS) are designed to operate at a nominal 480 Vac on the AC power port. Applications that require substantially different AC voltages can be accommodated by use of a transformer. This application note details considerations and requirements for successful installation.

Transformers are specified by primary voltages, secondary voltages and if the windings are Δ (Delta) or Y (wye) configured. Using typical nomenclature, the primary side is expected to be connected to the utility or grid connection and the secondary side is expected to be connected to the "customer" connection. Using this notation, the Ideal Power PCS will be connected to the "customer" or secondary side.

Generally, the primary utility side connection has line voltages referenced to neutral or ground. The common practice is to have the primary utility side connection be Δ configured. The Ideal Power PCS requires a Y configured transformer secondary with the center of the Y (often referred to as "H0") being grounded.

Warning: Under no circumstances should an ungrounded Δtransformer winding be connected to the PCS AC port. The preferred bi-directional installation of an Ideal Power PCS that is connected to a 208 Vac utility connection is as follows in Figure 1.

FIGURE 1.
DELTA – WYE



PREFERRED CONNECTION

Figure 1 is a Delta – Wye 208 to 480 Step up configuration. The 480 secondary side has a Wye configuration that allows the customer side to be grounded. The grounded center point of the wye becomes the neutral connection to the PCS.

The following examples are unacceptable configurations and will likely cause PCS product failures:

FIGURE 2. UNGROUNDED DELTA

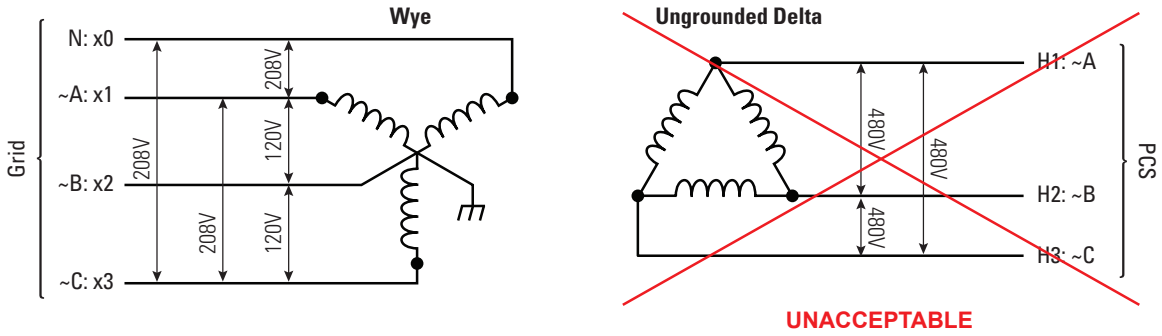
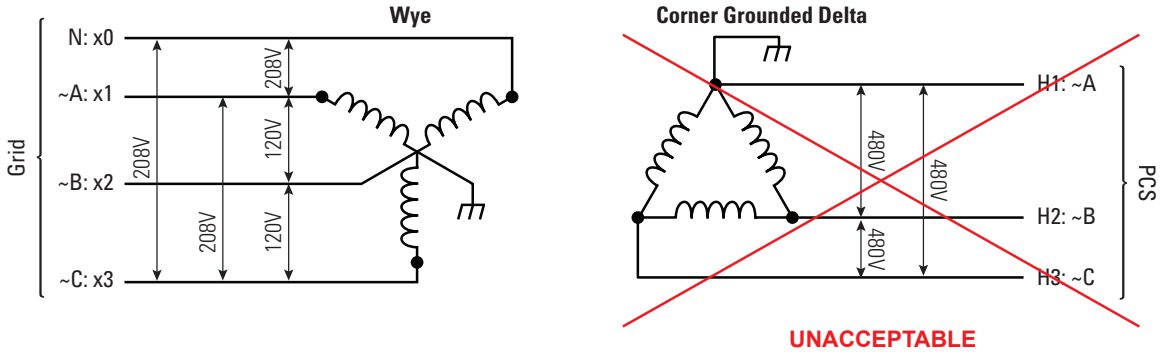


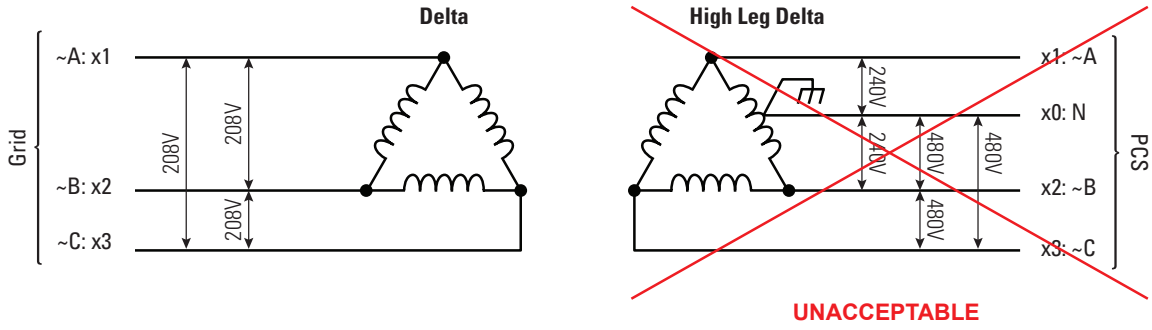
Figure 2 shows an ungrounded Δ facing the PCS. This must be avoided as the delta AC voltages are not constrained and can "float" to rather high potentials causing both damage to the PCS as well as personnel shock hazard. Note it does not matter if the grid side is Y or Δ.

FIGURE 3. CORNER GROUNDED DELTA



Another variation of a Δ facing the PCS in shown in Figure 3. The "corner grounded delta" configuration was used to prevent a dangerous floating Δ. This is an older configuration not recommended for or seen in new installations. The problem it creates is to double the peak line voltages with respect to ground. Further, the sum of the phase voltages with respect to ground are no longer zero volts but now becomes a 480 Vac 60 Hz signal. This configuration will damage the AC inputs of the PCS and should not be used. Note it does not matter if the grid side is Y or Δ.

FIGURE 4. HIGH LEG DELTA



A less common unacceptable transformer configuration is shown in Figure 4. This is a "high leg delta" connecting to the PCS. Other terms this may be referred to as are "Wild leg delta" and "Stinger leg delta".

For Micro grid applications, where the loads require a lower voltage than the PCS 480 Vac, a step-down transformer is needed.

In this case both the PCS winding and the load winding need grounded connections. This can be done in one of two ways:

1. 480 Vac Wye to 208 Vac Wye. The center connections of both wyes can be connected to ground

2. 480 Vac Wye auto transformer. The PCS connects to the 480 Vac terminals and the center of the wye is grounded. Load connections are taken off the lower voltage taps of the autotransformer.

SUMMARY:

a. Connections at the PCS AC port should be wired such that the three phase voltages with respect to ground are constrained to be symmetrical about ground.
   i. In other words, the sum of the AC phase voltages with respect to ground should always be zero.
   ii. This is ensured by the PCS facing a Y winding with a grounded center

b. Floating connections that are typical of Δ windings are unacceptable.

c. Corner grounded Δ configuration facing the PCS is unacceptable.

d. High leg Δ transformer configuration is unacceptable.

e. Micro grid step down configurations require a Y–Y or Y autotransformer to ensure that both the PCS AC port and the loads are ground referenced.

FREQUENTLY ASKED QUESTION

Can the Ideal PCS be connected to a customer transformer that is 480 V delta configuration on the converter side?

No, the converter must connect to a 480 V wye-grounded transformer.

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FOR ADDITIONAL QUESTIONS, PLEASE CONTACT:

Jayme Marquez – Applications Engineer
jayme.marquez@idealpower.com

WWW.IDEALPOWER.COM
4120 Freidrich Lane Suite 100 Austin, Texas 78744