# AIO

# Online Technical Resource

## Three Phase Current

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Three phase versus single phase 220 volt circuits: An ordinary circuit is called single phase and consists of two wires. Electric current flows through the two wires, first in one direction, then the other. The direction alternates 60 times per second. In three phase current, there are three wires. Current flows through each pair of those wires. The pulse of current through each pair occurs at a different time. The choice between single phase and three phase current applies, in general, only to electric motors and only at voltages of 220 volts or higher.

A 115 volt circuit has two wires, one for the current and one for the neutral. A single phase 220 volt circuit has three wires, two for current and one for neutral. A three phase 220 volt circuit has four wires, three for current and one for neutral.

How to tell if a building has three phase current: All American buildings are fed with 115 volt current. Most also have 220 volt current available, either single phase or three phase. If the 220 volt current is single phase, there are three wires coming into the building at the service entrance, two "hot" wires and a ground or neutral, and the electric pole outside has one transformer. A building with three phase current has four wires at the service entrance, three for the current plus a ground or neutral, and the electric pole usually has three transformers. Most buildings have separate breaker panels for single phase and three phase. The single phase panel controls the outlets and lighting circuits and is usually placed near the offices and classrooms. The three phase panel is usually near the cooling equipment, as those are usually the only devices which have electric motors large enough to need three phase current. A breaker for 115 volt single phase is 1/2" to 3/4" wide and breaks the current flowing to only one wire. A breaker for 220 volt single phase is twice as wide and breaks two circuits (two wires). A breaker for three phase is three times as wide and breaks three circuits.
Two kinds of Three Phase: Some three phase transformers are wired in a Y pattern. The center of the Y is the neutral, and the voltage from that neutral to any one of the three "hot" legs is 120 volts. The three phase voltage measures 208 rather than 240. There is no "high" leg, and there is no center tapped winding, as there are in Delta patterns. Other three phase transformers are wired in Delta, or triangle, pattern. Voltage between any of the two "hot" wires is 220 to 240 volts, depending on the place.

Connecting organ components to three phase current: Each of the three current wires, or "hot" wires, is called a "leg". One of the three transformers in a Delta system has a center tap. Voltage from the center tap to either of the end taps is 120 volts, but voltage from the center tap to the third leg, or "high" leg, is more like 208. A 120 volt device will be destroyed if it is connected between the center tap and the high leg. It is therefore very important to verify

voltages with a voltmeter before attaching devices and turning on the juice. The "high leg" wire must be orange and must be in the center of the fuse panel, switch, or motor starter. A single phase 220 volt device such as an organ rectifier can be connected to the two low legs, but it should not be connected between a low leg and a high leg, as the high voltage could destroy the single phase device. 110 volt devices are connected between the center tap and one of the center tapped coil leads.

Calculations: in Direct Current circuits, watts = volts times amps. In Alternating Current circuits, Watts = VA times power factor. In single phase A.C. circuits, VA = volts times amps. In three phase, VA = volts times amps times 1.732 (1.732 is the square root of 3).

Motor Wiring: Remember that wires should be large enough to carry the starting current. Also, Ampacity = 1.25 nameplate amperage rating.