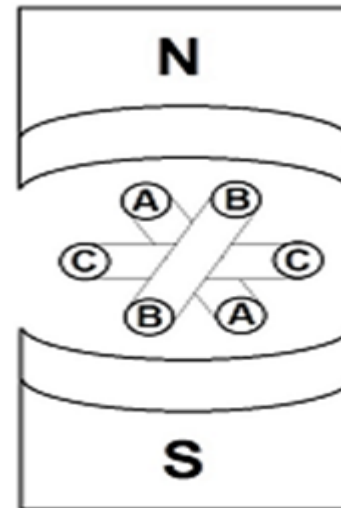
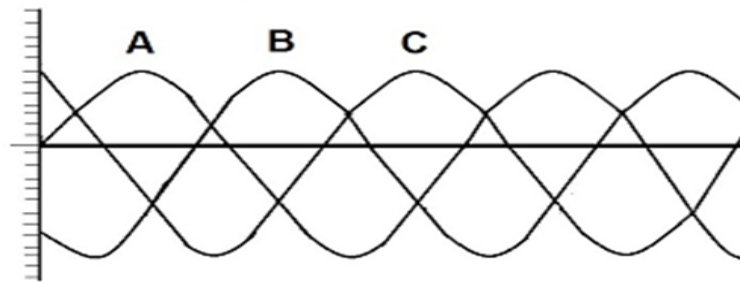


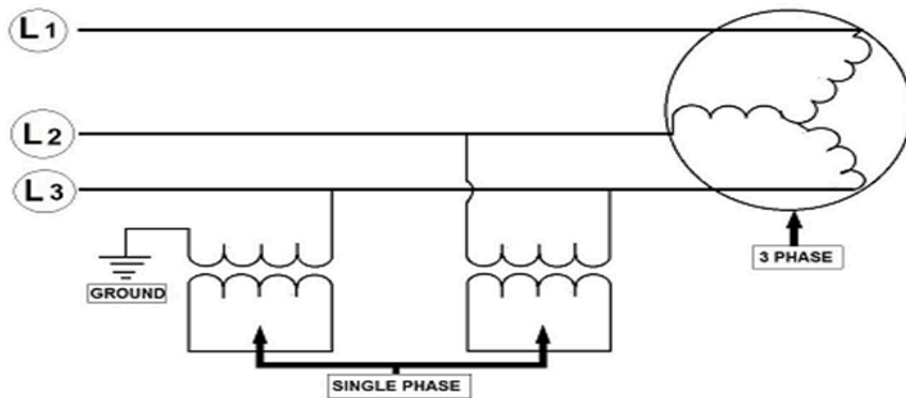
3-PHASE POWER

<https://www.youtube.com/watch?v=iMn7dq7B1oo>

Most power is distributed in the form of 3-phase AC. Basically, instead of just one coil turning in a generator, there are three coils, spaced 120 degrees apart.



Three-phase electricity powers large industrial loads more efficiently than single phase electricity. When single-phase electricity is needed, it is available between any two phases, or, in some systems, between one of the phases and ground.



DIFFERENCE BETWEEN SINGLE PHASE AND THREE PHASE POWER SUPPLIES

In this tutorial, we will learn the differences between Single Phase and Three Phase AC Power Supplies. We will see few basics of single phase and three phase systems, advantages and disadvantages and also some key differences between single and three phase power supplies.

Introduction

Almost 90% of the electrical energy we use in our day-to-day life is from alternating source. Be it our home appliances, office equipment or industrial machines, we use AC source to power these devices.

If you are a beginner, then Alternating Current or simply AC is a type of electric power in which the electric current changes periodically, both in magnitude and direction. Further, depending on the application, AC Power can be delivered in either a Single Phase or a Three Phase system.

A Single Phase AC Power system consists of two wires known as the phase (or sometimes a Line or Live or Hot) and the neutral wire. In case a three phase system, you use either three wires or four wires for transmitting power (no neutral in three wire three phase power and all the three wires are phases).

Let us now go into the details of single phase and three phase systems and also see the difference between single phase and three phase power supplies.

What is Single Phase Power Supply?

As mentioned earlier, in a Single Phase Power Supply, the power is distributed using only two wires called Phase and neutral. Since AC Power takes the shape of a sinusoidal wave, the voltage in a single phase supply peaks at 90° during the positive cycle and again at 270° during the negative cycle.

The phase wire carries the current to the load and the neutral wire provides the return path of the current. Usually, the single phase voltage is 230V and the frequency is 50Hz (this depends on where you live).

Since the voltage in a single phase supply rises and falls (peaks and dips), a constant power cannot be delivered to the load.

Advantages

- It is very common form of power supply to most small power requirement. Almost all residential supplies are single phase supplies as the domestic appliances require a small amount of power to run lights, fans, coolers, heaters, small air conditioners etc.
- The design and operation of a single phase power supply system is often simple.

- Depending on the region, a single phase supply is sufficient for loads up to 2500 Watts.

Disadvantages

- Small single phase motors (usually less than 1kW) cannot start directly with the help of a single phase supply as there isn't sufficient initial torque for the motor. So, additional circuitry like a Motor Starters (like a starter capacitor in fans and pumps) are needed for proper operation.
- Heavy loads like industrial motors and other equipment cannot be run on a single phase supply.

What is Three Phase Power Supply?

A Three Phase Power Supply consists of three power wires (or the three phases). Additionally, depending on the type of the circuit (which there are two types: Star and Delta), you might or might not have a neutral wire. In a three phase power supply system, each AC Power Signal is 120° out of phase with each other.

In a three phase power supply, during one cycle of 360° , each phase would have peaked in voltage twice. Also, the power never drops to zero. This steady stream of power and ability to handle higher loads makes a three phase supply suitable for industrial and commercial operations.

As mentioned earlier, there are two types of circuit configurations in a three phase power supply. They are the Delta and the Star (Y or Wye). In Delta configuration, there is no neutral wire and all the high voltage systems use this configuration.

Difference between Single and Three Phase Power Supplies

Let us now take a look at the difference between single phase and three phase power supplies.

- In a single phase power supply, the power is supplied through two wires called Phase and neutral. In three phase power supply, the power is supplied through three wires (four wires if neutral wire is included).
- The voltage of single phase supply is 230V whereas it is 415V in a three phase supply.
- For the same amount of power, a single phase supply requires more wire than that of a three phase supply.
- The efficiency of a three phase power supply is significantly higher than a single phase supply and the power transfer capability is also more.
- Since a single phase power supply uses only two wires, the overall complexity of the network is less when compared to a four wire three phase supply (neutral included).

Let us now see the comparison of Single Phase and Three Phase Power Supply Systems in a table:

Single Phase Power Supply requires two conductors	Three Phase Power Supply requires three conductors

The two wires (conductors) in single phase system are called Phase and Neutral	All the three wires (conductors) in three phase system are called phases
Since there is only a single wire, there is only one AC Signal (usually a Sinusoidal Wave)	The three wires in three phase supply carry AC signal of its own and the three signals are 120° apart
Power delivery in single phase supply is not consistent due to peaks and dips in voltage	Due to three conductors with 120° phase difference, the power delivery in three phase supply is always steady and consistent (the peaks and dips of the three AC signal are compensated by each other)
The supply voltage in single phase power supply is $\approx 230V$	In three phase power supply, the supply voltage is $\approx 415V$
Single Phase supply is relatively less efficient than a three phase supply for the same power delivery	Three Phase Power Supply is more efficient as it can deliver three times the power than a single phase power supply with just one additional wire
Usually, Single Phase Power Supply is served to residential and domestic needs (often, split phase from a three phase supply)	Three Phase Power Supply is usually served to large commercial centers and industries
It is ideal for small loads like lighting and heating	Three Phase Supply can handle large industrial motors
Single Phase Power Supplies always have a neutral wire (it acts as a return path from the load)	Neutral wire is optional in Three Phase Power Supplies (Delta Connections have no neutral wire, but Star Connections may or may not have neutral wire)
The chance of fault is higher as a Single Phase Power Supply has only one phase (if it fails, then there is no power)	Even if there is fault in one or two phases, the remaining phase(s) will continue to deliver power in Three Phase Power Supply. So, the chance of fault is less