


XPerts in Power - Module 1

Input Power Sources

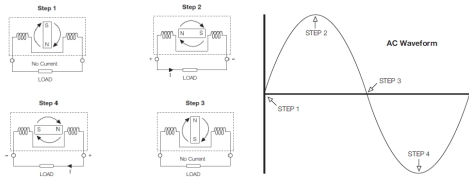
Stephen Dodson


Module Content

- AC Sources
 - Single Phase
 - Three Phase
- Power Station to Socket Overview
- DC Sources
 - What is a battery ?
 - Type of batteries

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Producing a Single-Phase Voltage



3

Producing a Three-Phase Voltage

The diagram illustrates the production of a three-phase voltage. On the left, a generator is shown with three stator windings labeled A, B, and C, and a central rotor with North (N) and South (S) poles. To the right, three sine waveforms are shown, labeled A, B, and C, which are phase-shifted by 120 degrees from each other. Further to the right, a larger set of three sine waveforms is shown, also labeled A, B, and C, representing the resulting three-phase voltage.

XP Power 4

Why do Power Stations Generate 3-Phase

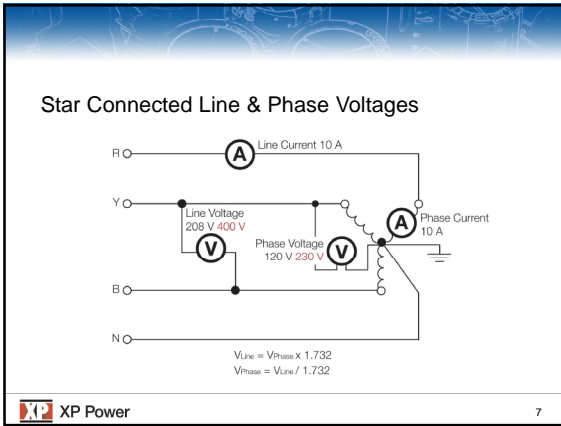
The diagram compares a single-phase sine wave on the left with a three-phase sine wave on the right. The three-phase waveforms are shown as three sine waves shifted by 120 degrees, demonstrating how they provide a more constant power output compared to a single-phase system.

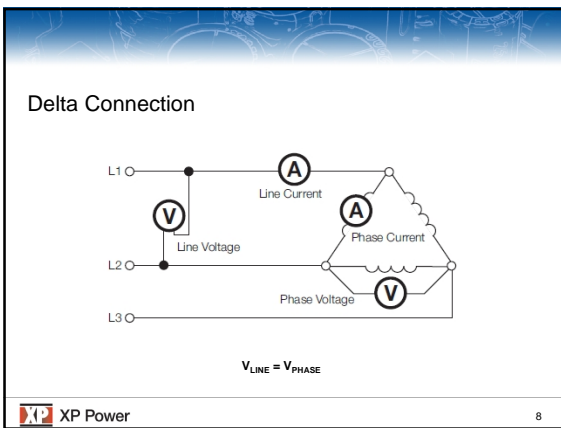
XP Power 5

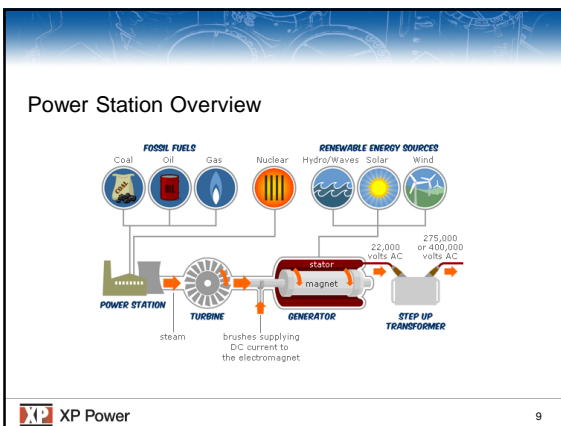
Star Connection

The diagram shows a star connection for a three-phase system. It includes three line voltages (L1, L2, L3) and a neutral line (N). A voltmeter labeled 'Line Voltage' is connected across two lines (L1 and L2). Another voltmeter labeled 'Phase Voltage' is connected across one line (L1) and the neutral line (N). The diagram also shows the internal winding configuration of a transformer or generator with a star point connected to ground.

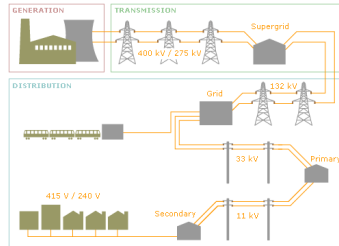
XP Power 6



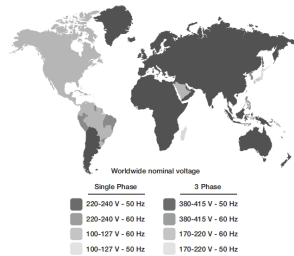




National Grid Overview

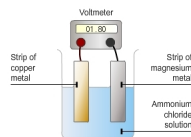


World Wide Voltage And Frequency



What is a Battery ?

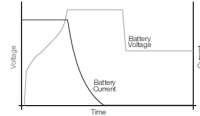
- A battery is an electricity storage device which can be found in any number of shapes, sizes, voltages and capacities.
- When two conducting materials (often dissimilar metals) are immersed in a solution, an electrical potential will exist between them. If connected together through a closed circuit, a current will flow. The value of this potential (or voltage) is dependent on the materials used, giving rise to a whole family of battery types each having benefits and restrictions in use. Examples are:- lead acid, nickel cadmium (Nicad), lithium, silver alkaline.



Value Regulated Lead Acid

Based on technology developed in the 1960's, these batteries recombine the gases that are produced within the battery casing during operation of the battery, thus minimising water loss.

- Advantages
 - Relatively low initial purchase cost
 - Minimal Maintenance required
 - 5, 10 & 15 year design life options available.
- Disadvantages
 - Recommended operation temperature 20-25°C
 - Battery life halved for every 10°C above 25°C
 - Battery state of charge can only be determined by external monitoring circuit.
 - Damaged if discharged to zero volts



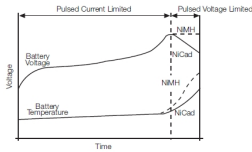
Nickel Cadmium & Nickel Metal Hydride

NiCad

- Older technology typically used in portable applications.
- High power density.
- High discharge rates
- Memory effect

NiMH

- More recent evolution of NiCad
- No memory effect



Lithium

- Typically used in portable applications.
- Higher power density than VRLA or Nickel
- Low self discharge rate
- Stringent charging regime

