



How Does An Alternator And A Voltage Regulator Work?

◆ How does Alternator produce electricity?

- ◆ The alternator is the part of the generator that produces the electrical output from the mechanical input supplied by the engine. It contains an assembly of stationary and moving parts encased in a housing. The components work together to cause relative movement between the magnetic and electric fields, which in turn generates electricity.
 - (a) Stator – This is the stationary component. It contains a set of electrical conductors wound in coils over an iron core.
 - (b) Rotor / Armature – This is the moving component that produces a rotating magnetic field in any one of the following three ways:
 - (i) By induction – These are known as brushless alternators and are usually used in large generators. An alternator that does not use brushes requires less maintenance and also produces cleaner power.
 - (ii) By permanent magnets – This is common in small alternator units.
 - (iii) By using an exciter – An exciter is a small source of direct current (DC) that energizes the rotor through an assembly of conducting slip rings and brushes.
- The rotor generates a moving magnetic field around the stator, which induces a voltage difference between the windings of the stator. This produces the alternating current (AC) output of the generator.

◆ What is a Voltage Regulator and how does it function?

- ◆ As the name implies, this component regulates the output voltage of the generator. The mechanism is described below against each component that plays a part in the cyclical process of voltage regulation.
 - (1) Voltage Regulator: Conversion of AC Voltage to DC Current – The voltage regulator takes up a small portion of the generator's output of AC voltage and converts it into DC current. The voltage regulator then feeds this DC current to a set of secondary windings in the stator, known as exciter windings.
 - (2) Exciter Windings: Conversion of DC Current to AC Current – The exciter windings now function similar to the primary stator windings and generate a small AC current. The exciter windings are connected to units known as rotating rectifiers.
 - (3) Rotating Rectifiers: Conversion of AC Current to DC Current – These rectify the AC current generated by the exciter windings and convert it to DC current. This DC current is fed to the rotor / armature to create an electromagnetic field in addition to the rotating magnetic field of the rotor / armature.
 - (4) Rotor / Armature: Conversion of DC Current to AC Voltage – The rotor / armature now induces a larger AC voltage across the windings of the stator, which the generator now produces as a larger output AC voltage.
- ◆ This cycle continues until the generator begins to produce output voltage equivalent to its full operating capacity. As the output of the generator increases, the voltage regulator produces less DC current. Once the generator reaches full operating capacity, the voltage regulator attains a state of equilibrium and produces just enough DC current to maintain the generator's output at full operating level.
- ◆ When you add a load to a generator, its output voltage dips a little. This prompts the voltage regulator into action and the above cycle begins. The cycle continues till the generator output ramps up to its original full operating capacity.