

RECTIFIER

Any electrical device which offers a low resistance to the current in one direction but a high resistance to the current in the opposite direction is called rectifier. Such a device is capable of converting a sinusoidal input waveform, whose average value is zero, into a unidirectional waveform, with a non-zero average component. A rectifier is a device, which converts a.c. voltage (bi-directional) to pulsating d.c. voltage (Unidirectional).

Rectifier is a device which converts the sinusoidal AC voltage into either positive or negative pulsating DC **Rectifier**



Characteristics of a Rectifier Circuit:

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A rectifier is a device, which converts a.c. voltage (bi-directional) to pulsating d.c.. Load currents: They are two types of output current. They are average or d.c. current and RMS currents.

Average or DC current: The average current of a periodic function is defined as the area of one cycle of the curve divided by the base.

It is expressed mathematically as

- i) Average value/dc value/mean value = $\frac{\text{Area over one period}}{\text{Total time period}}$

$$V_{dc} = \frac{1}{T} \int_0^T V d(wt)$$

- ii) Effective (or) R.M.S current:

The effective (or) R.M.S. current squared of a periodic function of time is given by the area of one cycle of the curve, which represents the square of the function divided by the base.

$$V_{rms} = \sqrt{\frac{1}{T} \int_0^T V^2 d(wt)}$$

- iii) Peak factor:

It is the ratio of peak value to Rms value

$$\text{Peak factor} = \frac{\text{peakvalue}}{\text{rmsvalue}}$$

- iv) Form factor:

It is the ratio of Rms value to average value

$$\text{Form factor} = \frac{\text{Rmsvalue}}{\text{averagevalue}}$$

v) Ripple Factor (Γ): It is defined as ration of R.M.S. value of a.c. component to the d.c. component in the output is known as “Ripple Factor”.

$$\Gamma = \frac{V_{ac}}{V_{dc}}$$

$$V_{ac} = \sqrt{V_{rms}^2 - V_{dc}^2}$$

vi) Efficiency (η):

It is the ratio of d.c output power to the a.c. input power. It signifies, how efficiently the rectifier circuit converts a.c. power into d.c. power.

$$\eta = \frac{o/p \text{ power}}{i/p \text{ power}}$$

vii) Peak Inverse Voltage (PIV):

It is defined as the maximum reverse voltage that a diode can withstand without destroying the junction.

viii) Transformer Utilization Factor (UTF):

The d.c. power to be delivered to the load in a rectifier circuit decides the rating of the Transformer used in the circuit. So, transformer utilization factor is defined as

$$TUF = \frac{P_{dc}}{P_{ac(rated)}}$$

ix) % Regulation:

The variation of the d.c. output voltage as a function of d.c. load current is called regulation. The percentage regulation is defined as

$$\% \text{ Regulation} = \frac{V_{NL} - V_{FL}}{V_{FL}} * 100$$

For an ideal power supply, % Regulation is zero.