Week No -2

- Three phase rectifier circuits by using diodes .
- Output voltage waveform, diode current waveform.
- Output voltage equation in case of resistive load .



Three-Phase Half Wave Rectifier















Example

The rectifier in Fig is operated from 460 V 50 Hz supply at secondary side and the load Ω resistance is *R*=20. If the source inductance is negligible, determine (a) Rectification efficiency, (b) Form factor (c) Ripple factor (d) Peak inverse voltage (PIV) of each

diode.

$$V_{S} = \frac{460}{\sqrt{3}} = 265.58 \ V, \qquad V_{m} = 265.58^{*} \quad \sqrt{2} = 375.59 \ V$$

$$V_{dc} = {}^{3} \sqrt{\frac{3}{2\pi}} V_{m} = 0.827 \ V_{m} \qquad I_{dc} = {}^{3} \sqrt{\frac{3}{2\pi}} V_{m} = {}^{0827V_{m}} R$$

$$V_{rms} = 0.8407 \ V_{m} \qquad I_{rms} = {}^{0.8407 \ V_{m}} R$$

$$\eta = \frac{P_{dc}}{P_{ac}} = \frac{V_{dc} \ I_{dc}}{V_{rms} \ I_{rms}} = 96.767 \ \%$$

$$FF = \frac{V_{rms}}{V_{dc}} = 101.657$$

$$RF = \frac{V_{ac}}{V_{dc}} = \sqrt{V_{rms}^{2} - V \ \frac{2}{dc}} \qquad \sqrt{\frac{V_{rm}^{2}}{V_{c}^{2}}} - 1 = \sqrt{FF^{2} - 1} = 18.28 \ \%$$
The PIV= $3\sqrt{V_{m}} = 650$

$$V_{dc} = \frac{3}{\pi} \int_{\pi/3}^{2\pi/3} \sqrt{3} V_m \sin \omega t \, d\omega t = \frac{3\sqrt{3}}{\pi} V_m = \frac{3\sqrt{2}}{\pi} V_{LL} = 1.654 V_m = 1.3505 V_{LL}$$

$$I_{dc} = \frac{3\sqrt{3}}{\pi} V_m = \frac{1.654 V_m}{R} = \frac{3\sqrt{2}}{\pi} V_{LL} = \frac{1.3505 V_{LL}}{\pi R}$$

$$V_{rms} = \sqrt{\frac{3}{\pi}} \int_{-\infty}^{2\pi/3} \sqrt{3} V_m \sin \frac{2}{3} d\omega t = \sqrt{\frac{3}{2}} + \frac{9*}{4\pi} \sqrt{\frac{3}{\pi}} V_m = 1.6554 V_m = 1.3516 V_{LL}$$

$$I_{rms} = \frac{1.6554}{R} V_m$$

$$I_r = \frac{1.6554}{R} \sqrt{\frac{V_m}{3}} = 0.9667 \frac{-V_m}{R}$$

$$I_S = 0.9667 \sqrt{\frac{2}{2}} \frac{-V_m}{R}$$

Lesson Summary

- Three phase uncontrolled rectifiers are available in half wave and full wave configuration.
- Three phase uncontrolled half wave rectifier require three phase four wire power supply.
- The input ac line current in a three phase uncontrolled half wave rectifier contain dc component which may cause "dc saturation" of input transformer.
- Three phase full wave uncontrolled rectifier is most widely used in the medium power applications particularly as the input stage of the dc link inverter.
- Three phase full wave uncontrolled rectifier uses six diodes instead of three of the half wave rectifier.