2.8 Six-phase half-wave rectifier

The output voltage waveform has a six-pulse characteristic.

$$V_o = \frac{1}{2\pi/6}\int_{-\frac{\pi}{6}+\alpha}^{\frac{\pi}{6}+\alpha} V_m \cos\omega t \, d\omega t$$

$$= \frac{3V_m}{\pi}\left(\sin\omega t\right)_{-\frac{\pi}{6}+\alpha}^{\frac{\pi}{6}+\alpha}$$

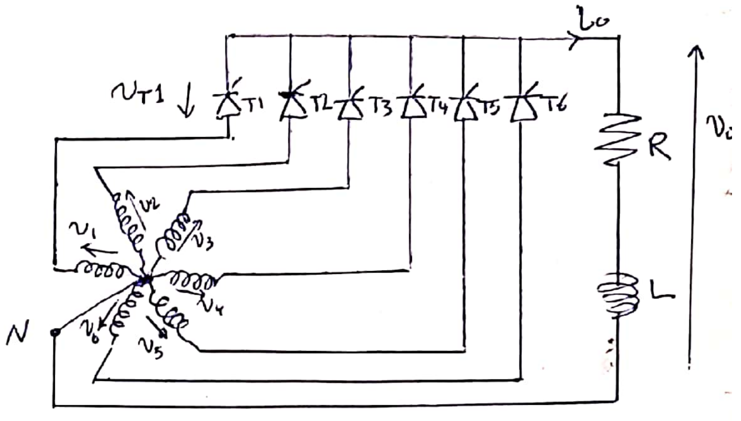
$$= \frac{3V_m}{\pi}\left[\sin(\tfrac{\pi}{6}+\alpha) - \sin(\tfrac{-\pi}{6}+\alpha)\right]$$

$$= \frac{3V_m}{\pi}\left[2\sin\tfrac{\pi}{6}\cos\alpha\right]$$

$$= \frac{3V_m}{\pi}\cos\alpha$$

P.F.V = P.R.V = $2V_m$

In this star connection the currents reflected in primary side of transformer have a large third-harmonic component. To eliminate the third-harmonic component, a connection [called fork connection] can be used, but more frequently a double-star connection is used.



(a)

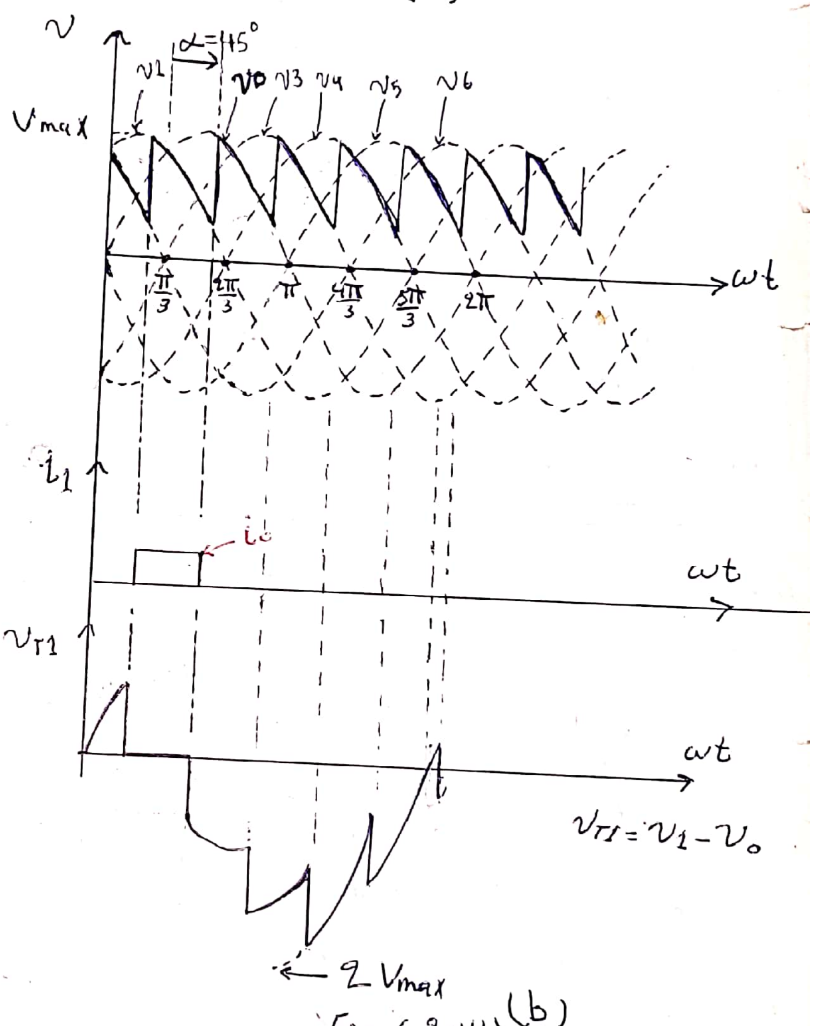
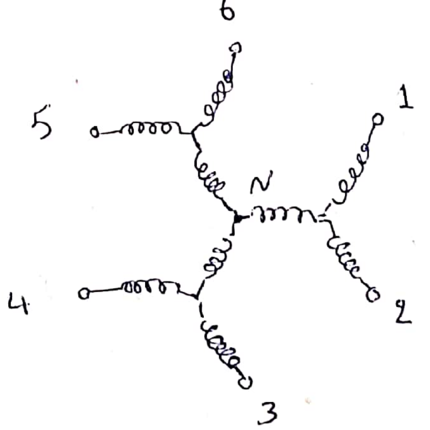


Fig (2-14) (b)



Six-phase fork connection

Fig. (2-15)

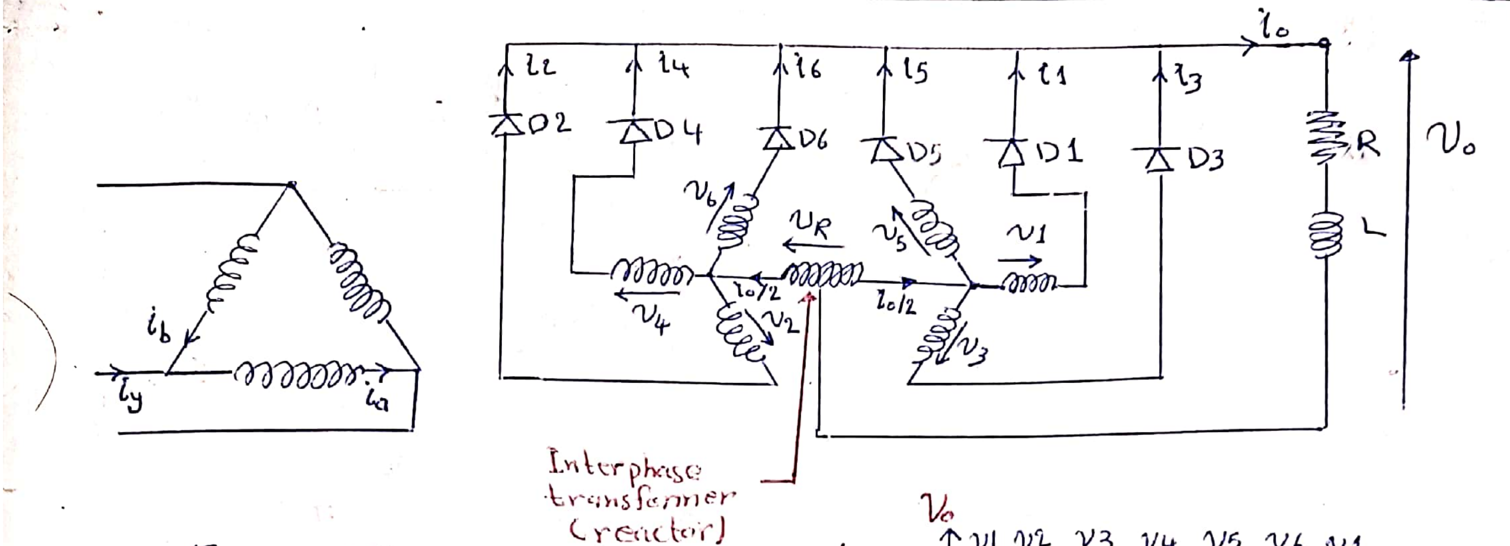


Fig (2.16)

Double-star six-phase half-wave circuit

$$V_o = \frac{1}{2\pi/6}\int_{-\pi/6}^{\pi/6} (V_m \sin\tfrac{\pi}{3}) \cos\omega t \, d\omega t$$

$$= \frac{3\sqrt{3}\,V_m}{2\pi}$$

The output voltage waveform shows the two three-pulse waveforms of each star group relative to its own star point. The reactor allows each star group to conduct at the same time by taking up the voltage difference between the two star points. The output voltage has a six-pulse charcterstics with maximum instantaneous value of ($V_m \sin\frac{\pi}{3} = \frac{\sqrt{3}}{2} V_{max}$) occuring where the phase voltages cross.

The reactor voltage V_R is the difference between the two star groups, having an approximately traingular shape with a maximum value of $0.5\,V_{max}$ and is at a frequency of three times that of the supply.

Peak revers voltage (P.R.V) = $2V_m$