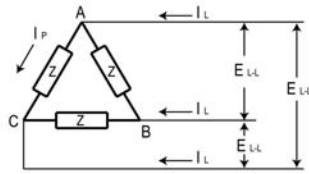


3 Phase Balanced Loads

3-Phase Delta



$$P = 1.73 E_{L-L} I_P \cos \theta = \frac{3(E_{L-L})^2}{Z}$$

$$Z = \frac{1.73 E_{L-L}}{I_L}$$

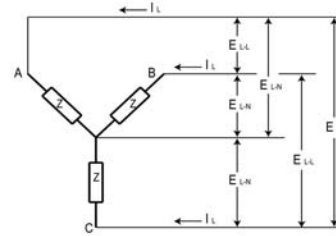
$$I_P = \frac{I_L}{1.73}$$

- The current in each element is equal to the line current I_L divided by $\sqrt{3}$.
- The voltage across each element is equal to the line voltage E_{L-L} .
- The impedance of each element is equal to $\sqrt{3}$ times the voltage across each element divided by the line current.
- The voltage across the elements are 120° out of phase.
- The currents in the elements are 120° out of phase.
- The power is equal to $\sqrt{3}$ times voltage across each element times the current I_L times $\cos \theta$.

P = power in watts

θ = phase angle in degrees

3-Phase WYE



$$P = 3 E_{L-N} I_L \cos \theta = 1.73 E_{L-L} I_L \cos \theta$$

$$I_L = \frac{E_{L-N}}{Z} = \frac{E_{L-L}}{1.73 Z}$$

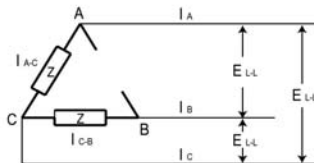
$$E_{L-N} = \frac{E_{L-L}}{1.73}$$

$$Z = \frac{E_{L-L}}{1.73 I_P}$$

- The current in each element is equal to the line current I_L .
- The voltage across each element E_{L-N} is equal to the line voltage E_{L-L} divided by $\sqrt{3}$.
- The impedance of each element is equal to line voltage E_{L-L} divided by $\sqrt{3}$ times the line current.
- The voltages across the elements are 120° out of phase.
- The currents in the elements are 120° out of phase.
- The power is equal to 3 times line voltage E_{L-N} times line current times $\cos \theta$.
- For a balanced load the current in the neutral is equal to zero.

3 Phase Unbalanced Loads

3-Phase Delta



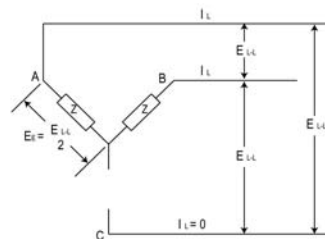
$$P = \frac{2(E_{L-L})^2}{Z}$$

$$I_{A-C} = I_{C-B} = I_A = I_B = \frac{E_{L-L}}{Z}$$

$$I_C = 1.73 I_A = 1.73 I_B$$

- The current in each non-open element is equal.
- The current in the connecting leg of the non-open elements is $\sqrt{3}$ times the current in any other leg.

3-Phase WYE (No neutral)



$$P = E_{L-L} I_L \cos \theta$$

$$I_L = \frac{E_{L-L}}{2 Z}$$

- The current in each non-open element is equal to the line current.
- The voltage across each non-open element is equal to the line voltage divided by 2.
- The power is equal to the line voltage times the line current times $\cos \theta$.