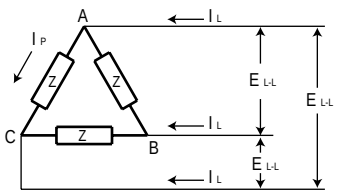
3-Phase Balanced & Open Leg Networks

3-Phase Balanced Circuits

3-Phase Delta



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

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

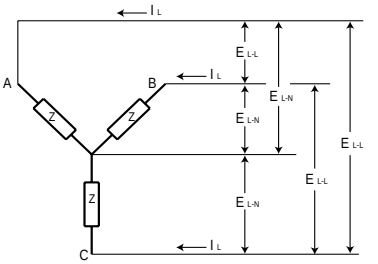
$$I_P = \frac{I_L}{1.73}$$

- 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 $E_{L\text{-}L}$.
- 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 120Þ out of phase.
- The currents in the elements are 120Þ out of phase.
- The power is equal to $\sqrt{3}$ times voltage across each element times the current I_L times COS Θ.

P = power in watts

Θ = phase angle in degrees

3-Phase WYE



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

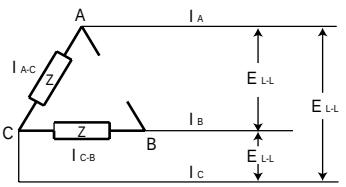
$$I_L = \frac{E_{L\text{-}N}}{Z} = \frac{E_{L\text{-}L}}{1.73\ Z}$$

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

- The current in each element is equal to the line current I.
- The voltage across each element $E_{L\text{-}N}$ is equal to the line voltage $E_{L\text{-}L}$ divided by $\sqrt{3}$.
- The impedance of each element is equal to line voltage $E_{L\text{-}L}$ divided by $\sqrt{3}$ times the line current.
- The voltages across the elements are 120Þ out of phase.
- The currents in the elements are 120Þ out of phase.
- The power is equal to 3 times line voltage $E_{L\text{-}N}$ times line current times COS Θ.
- For a ballanced load the current in the neutral is equal to zero.

3-Phase Open Leg

3-Phase Delta



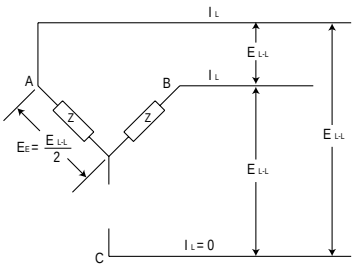
$$P = \frac{2(E_{L\text{-}L})^2}{Z}$$

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

$$I_C = 1.73\ I_A = 1.73\ I_B$$

- 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)



$$P = E_{L\text{-}L}\ I_L\ \text{COS}\ \theta$$

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

- 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 Θ.