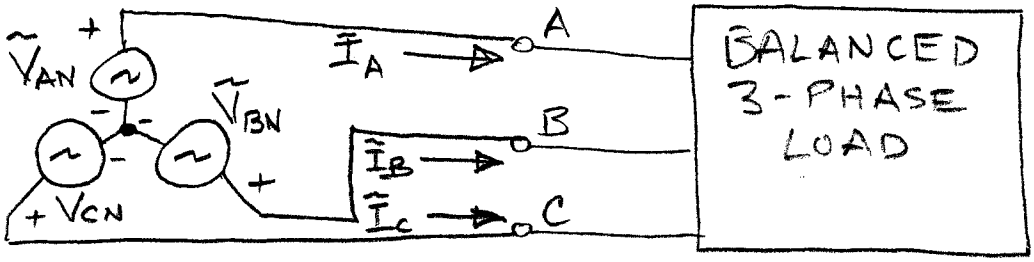
EE3120 Quiz Mar 17, 2006 Q2 → 16

Choose either front or back, do not do both. +1 NAME 36

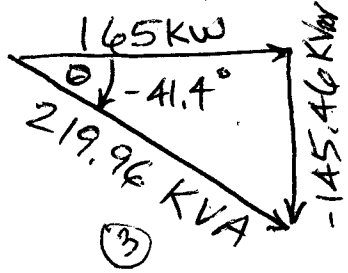
In each of the following cases, a balanced positive-sequence 3-phase source supplies a balanced 3-phase load. For all phasor calculations, assume that V_{AN} is the "reference." (The angle of V_{AN} is 0°)



For each case, first draw the power triangle for the load, labeling P,Q,S, and θ.

a) V_{LL} = 34.5 kV RMS. The load consumes 165 kW at a PF of 0.75 LEAD. Calculate the phasor values of I_A and I_B flowing into the load.

(7)

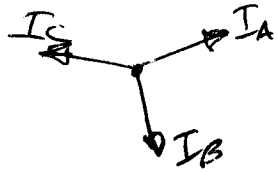


(3)

$$I_A = \frac{165{,}000}{\sqrt{3} \times 34{,}500 \times PF} = 3.68\text{A}$$

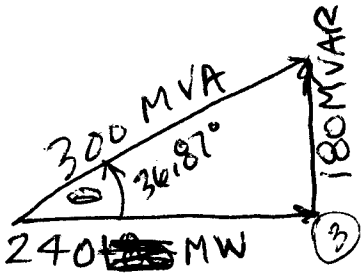
(2) $\tilde{I}_A = 3.68 \angle +41.4°\ \text{A}$

(2) $\tilde{I}_B = 3.68 \angle -78.6°\ \text{A}$



b) V_{LL} = 69 kV RMS. The load consumes 300 MVA at a PF of 0.8 LAG. Calculate the phasor value of I_A flowing into the load.

(6)



(3)

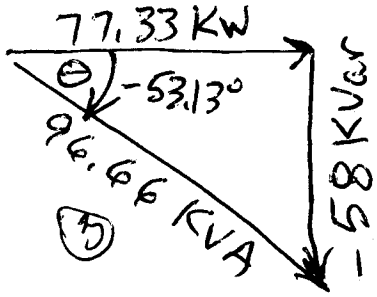
$$I_A = \frac{300 \times 10^6}{\sqrt{3} \times 69 \times 10^3} = 2{,}510\text{ A}$$

(3) $\tilde{I}_A = 2510 \angle -36.87°\text{A}$

c) V_{LL} = 480 V RMS. The load generates 58 kVAR. The PF is known to be 0.6, but it was not noted whether it is LEAD or LAG. Calculate the phasor value of I_A flowing into the load. Is the PF LEAD or LAG? Explain.

(7)

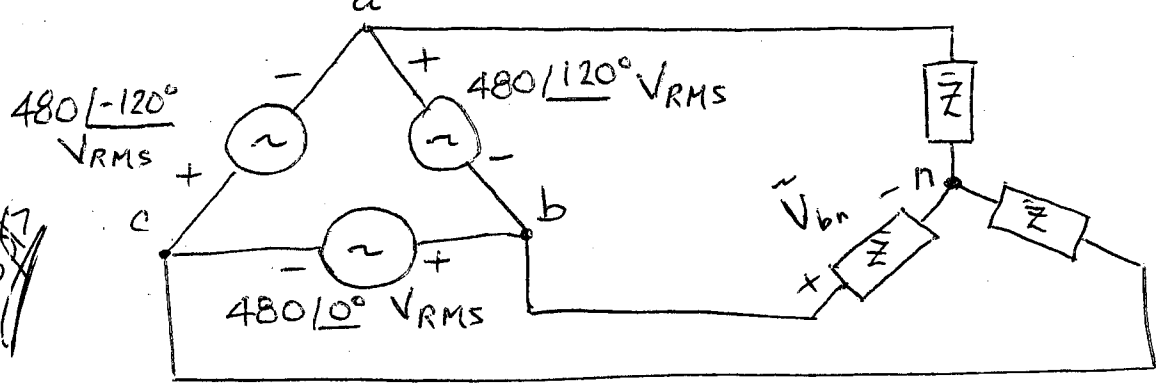
(2) ⇒ Leading PF



(5)

(2) $\tilde{I}_A = \frac{58{,}000}{\sqrt{3} \times 480 \times \sin\theta} \angle -\theta$

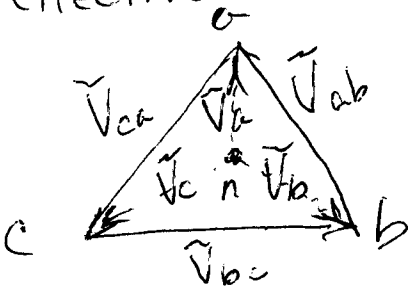
$\tilde{I}_A = 87.2 \angle +53.13°$



$\bar{Z} = 24 \angle 60° \Omega$

a) Draw a phasor diagram showing the relationship between the L-L voltages of the source and the effective L-N voltages.

(5)



b) Label $\tilde{V}_{bn}$ at the load. What is its phasor value? What is the current $\tilde{I}_{bn}$?

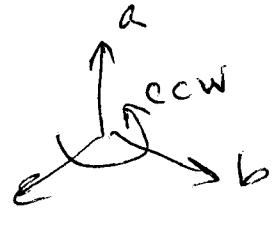
(5) From a) $\tilde{V}_{bn} = \frac{277}{\sqrt{3}} \angle -30° \text{ V}$

$$\tilde{I}_{bn} = \tilde{V}_{bn} / \bar{Z} = \frac{\frac{277}{\sqrt{3}} \angle -30°}{24 \angle 60} = 11.54 \angle -90° \text{ A}$$

c) Is the voltage source positive sequence or negative? Explain or show why.

(4) Positive Sequence

a-b-c for ccw rotation.



d) What is the RMS magnitude of:

(6)
- The phase current of the load. → 11.54 A
- The line current. → 11.54 A
- the phase current of the source. → $\frac{11.54}{\sqrt{3}} = 6.67$ A