24-1 A balanced Y load having a 10Ω resistance in each leg is connected to a three-phase, four-wire, Y connected generator having a line voltage of 208V. Calculate the magnitude of:

a) the phase voltage of the generator

$E_L = E_\phi \sqrt{3}$

$208V = E_\phi \sqrt{3}$ $\boxed{E_\phi = 120V}$

ALL voltages and current in RMS

b) the phase voltage of the load

$V_\phi = E_\phi = \boxed{208V}$

c) the phase current of the load

$I_\phi = \frac{V_\phi}{R_\phi} = \frac{120V}{10\Omega} = \boxed{12A}$

d) the line current

$I_L = I_\phi = \boxed{12A}$

24-3 Repeat problem 1 if each phase is changed to a 10Ω resistor in parallel with a 10Ω capacitive reactance

ALL voltages and current in RMS

a) $E_L = E_\phi \sqrt{3}$

$208V = E_\phi \sqrt{3}$ $\boxed{E_\phi = 120V}$

b) $V_\phi = E_\phi = \boxed{120V}$

c) $Z_\phi = 10\Omega // -j10\Omega = 7.07 \angle -45$

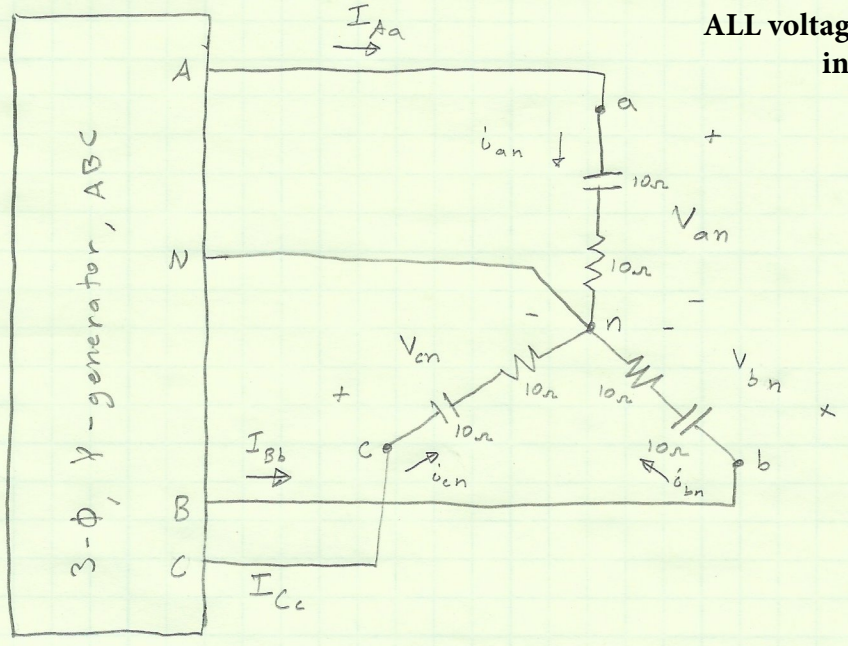
$I_\phi = \frac{V_\phi}{Z_\phi} = \frac{120V}{7.07\Omega^*} = \boxed{16.97A}$

*Only magnitude is desired, which is why the phase angle is neglected

d) $I_L = I_\phi = \boxed{16.97A}$

⑦ For the system below, find the unknown voltages & currents:

ALL voltages and current in RMS



$E_{AB} = 220V\angle 0°$ $E_{BC} = 220V\angle 120$ $E_{CA} = 220V\angle -120$

$$V_{an} = V_{bn} = V_{cn} = \frac{V_{AB}}{\sqrt{3}} = \boxed{127\,V}$$

$$Z_\Phi = (10\Omega - j10\Omega) = (14.14\Omega\angle -45°)$$

$$i_{an} = i_{bn} = i_{cn} = \frac{V_{an}}{Z_\Phi} = \frac{127\,V}{14.14\Omega} = \boxed{8.98\,A}$$

$$i_{Aa} = i_{Bb} = i_{Cc} = i_{an} = \boxed{8.98\,A}$$

(11) A balanced Δ-load having 20Ω resistance in each leg is connected to a 3-Φ, Y-generator having a line voltage of 208V. Calculate:

ALL voltages and current in RMS

a) The phase voltage of the generator

$$E_\Phi = \frac{V_L}{\sqrt{3}} = \frac{208V}{\sqrt{3}} = \boxed{120V}$$

b) The phase voltage of the load

$$V_\Phi = E_\Phi = \boxed{208V}$$

c) The phase current of the load

$$I_\Phi = \frac{V_\Phi}{Z_\Phi} = \frac{208V}{20\Omega} = \boxed{10.4A}$$

d) The line current

$$I_L = I_\Phi \sqrt{3} = (10.4A)\sqrt{3} = \boxed{18A}$$

17. For the system in Fig. 24.48, find the magnitude of the unknown voltages and currents

ALL voltages and current in RMS

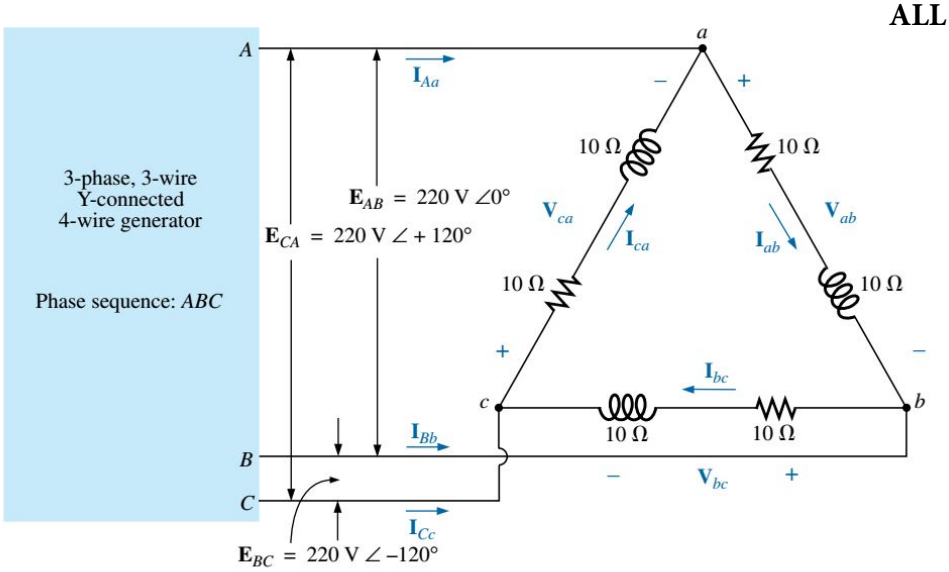


FIG. 24.48

(a) Phase Voltages:

$$\mathbf{V}_{ab} = E_{AB} = 220\ V\angle 0°$$
$$\mathbf{V}_{bc} = E_{BC} = 220\ V\angle -120°$$
$$\mathbf{V}_{ca} E_{CA} = 220\ V\angle 120°$$

(b) Phase Currents:

$$\mathbf{I}_{ab} = \frac{V_{ab}}{Z_{ab}} = \frac{220\ V\angle 0°}{10+j10} = 15.56\ A\angle -75°$$
$$\mathbf{I}_{bc} = \frac{V_{bc}}{Z_{bc}} = \frac{220\ V\angle -120°}{10+j10} = 15.56\ A\angle -195°$$
$$\mathbf{I}_{ca} = \frac{V_{ca}}{Z_{ca}} = \frac{220\ V\angle 120°}{10+j10} = 15.56\ A\angle 45°$$

(c) Line Currents:

$$I_{Aa} = I_{Bb} = I_{Cc} = \sqrt{3} \cdot I_{ab} = 26.9\ A$$