BALANCED 3ϕ

ALL PHASE / LINE VOLTAGE EQUAL

CURRENT EQUAL

PHASE DISPLACEMENT 120°

UNBALANCED 3ϕ

- UNBALANCED LOADING
- SHORT CIRCUIT
- PARTIAL SHORT
- OPEN PHASE
- PHASE TO GROUND

→

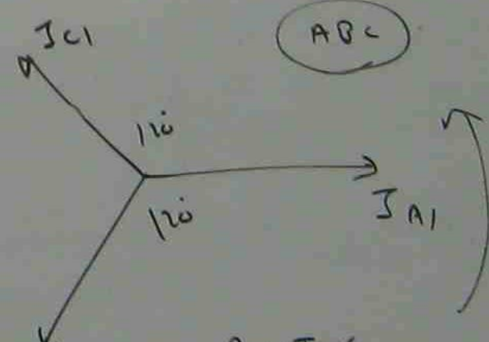
- UNEQUAL PHASE / LINE VOLTAGE
- UNEQUAL PHASE / LINE CURRENT
- PHASE DISPLACEMENT MAY NOT BE 120°

$j = 1\angle 90^\circ$, $j^2 = 1\angle 180^\circ$, $j^3 = 1\angle 270^\circ$

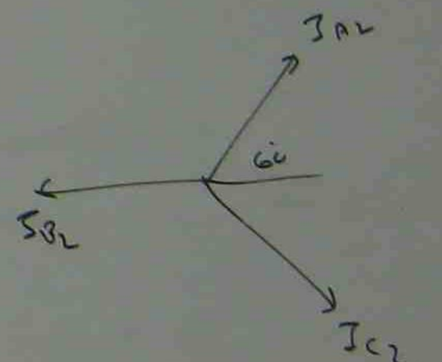
$(j = \sqrt{-1})$

a = PHASE DISPLACEMENT = $1\angle 120^\circ$

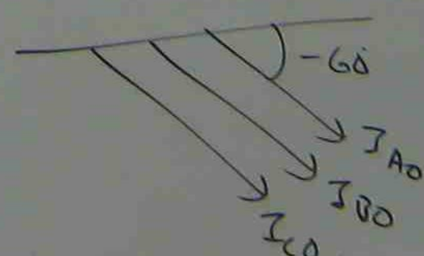
$a^2 = 1\angle 240^\circ$



POSITIVE SEQUENCE



NEGATIVE SEQUENCE VECTOR



ZERO SEQUENCE

$$I_A = I_{A1}^{+} + I_{A2}^{-} + I_{A0}^{0}$$

$$I_B = I_{B1}^{+} + I_{B2}^{-} + I_{B0}^{0}$$

$$I_C = I_{C1}^{+} + I_{C2}^{-} + I_{C0}^{0}$$

$$I_{A1}^{+} = \frac{1}{3}\left(I_A + a I_B + a^2 I_C\right)$$

$$I_{A2}^{-} = \frac{1}{3}\left(I_A + a^2 I_B + a I_C\right)$$

$$I_{A0}^{0} = \frac{1}{3}\left(I_A + I_B + I_C\right)$$

I_{B1} SAME MAGNITUDE AS I_{A1} BUT -120° DIFFERENCE

I_{C1} SAME MAGNITUDE AS I_{A1} BUT $+120^\circ$ DIFFERENCE

I_{B2} SAME MAGNITUDE AS I_{A2} BUT $+120°$ DIFFERENCE

I_{C2} SAME MAGNITUDE AS I_{A2} BUT $-120°$ DIFFERENCE

$I_{B0} = I_{C0} = I_{A0}$ THERE IS $-60°$ PHASE ANGLE

$$I_A = \overset{+}{I}_{A1} + \overset{-}{I}_{A2} + \overset{0}{I}_{A0}$$

$$I_B = \overset{+}{I}_{B1} + \overset{-}{I}_{B2} + \overset{0}{I}_{B0}$$

$$I_C = \overset{+}{I}_{C1} + \overset{-}{I}_{C2} + \overset{0}{I}_{C0}$$

$$\overset{+}{I}_{A1} = \frac{1}{3}\left(I_A + a I_B + a^2 I_C\right)$$

$$\overset{-}{I}_{A2} = \frac{1}{3}\left(I_A + a^2 I_B + a I_C\right)$$

$$\overset{0}{I}_{A0} = \frac{1}{3}\left(I_A + I_B + I_C\right)$$

I_{B1} SAME MAGNITUDE AS I_{A1} BUT $-120°$ DIFFERENCE

I_{C1} SAME MAGNITUDE AS I_{A1} BUT $+120°$ DIFFERENCE

I_{B2} SAME MAGNITUDE AS I_{A2} BUT $+120°$ DIFFERENCE

I_{C2} SAME MAGNITUDE AS I_{A2} BUT $-120°$ DIFFERENCE

$I_{B0} = I_{C0} = I_{A0}$ THERE IS $-60°$ PHASE ANGLE

I_{B_2} SAME MAGNITUDE AS I_{A_2} BUT $+120°$ DIFFERENCE

I_{C_2} SAME MAGNITUDE AS I_{A_2} BUT $-120°$ DIFFERENCE

$I_{B_0} = I_{C_0} = I_{A_0}$ THERE IS $-60°$ PHASE ANGLE

$I_{A_1} = I \angle \theta_1$ $\quad I_{B_1} = I \angle \theta - 120°$ $\quad I_{C_1} = I \angle \theta + 120°$

$I_{A_2} = I_1 \angle \theta_2$ $\quad I_{B_2} = I_1 \angle \theta_2 + 120°$ $\quad I_{C_2} = I_1 \angle \theta_2 - 120°$