

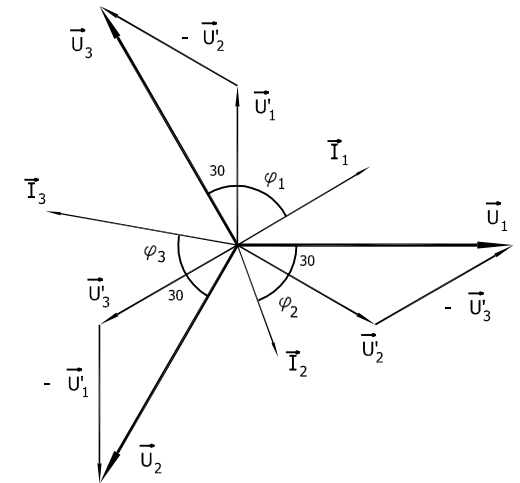
$\vec{E}_1 = \vec{U}_{1N} = U_F \angle 90$
 $\vec{E}_2 = \vec{U}_{2N} = U_F \angle -30$
 $\vec{E}_3 = \vec{U}_{3N} = U_F \angle -150$

Tensiones simples

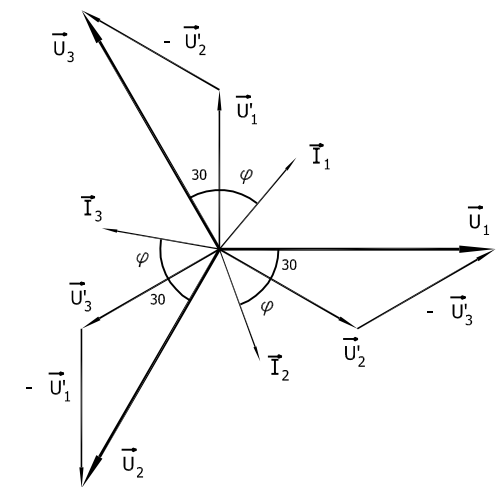
$\vec{U}_{12} = U_L \angle 120$
 $\vec{U}_{23} = U_L \angle 0$
 $\vec{U}_{31} = U_L \angle -120$

Tensiones compuestas
 $U_L = \sqrt{3} U_F$

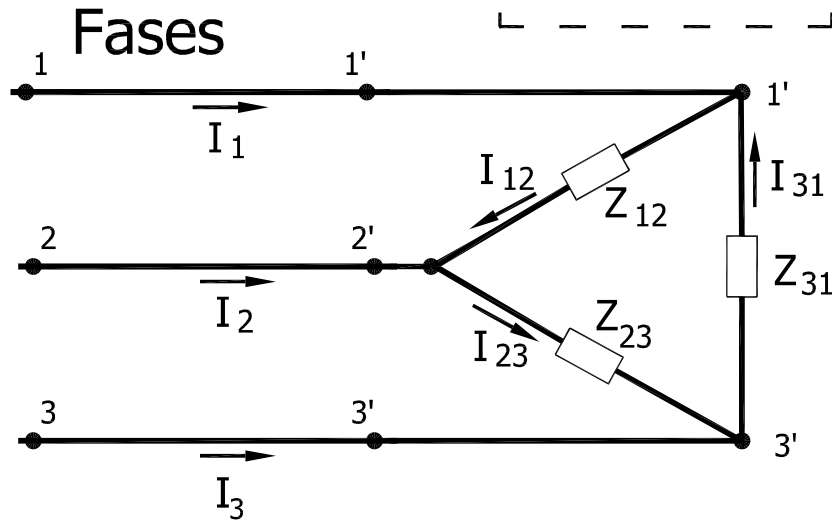
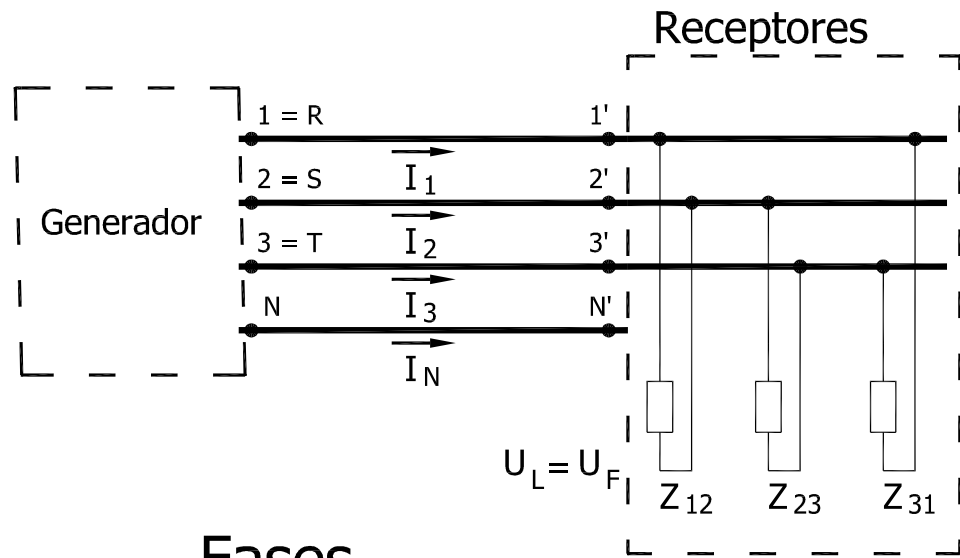
Sistema Desequilibrado en Intensidades



Sistema Equilibrado en Intensidades



Carga Trifásica en TRIANGULO



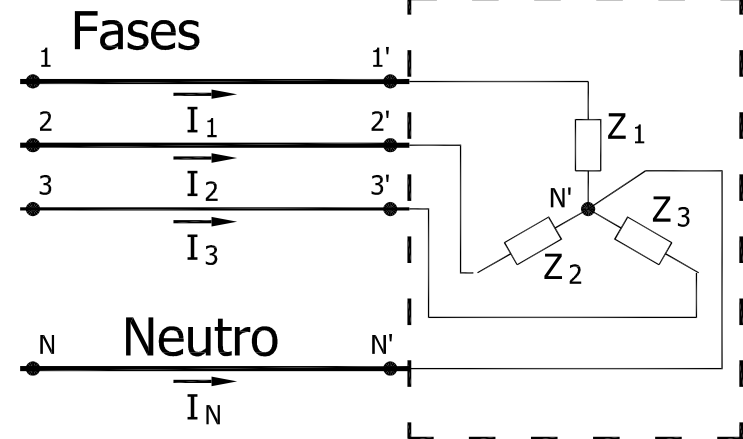
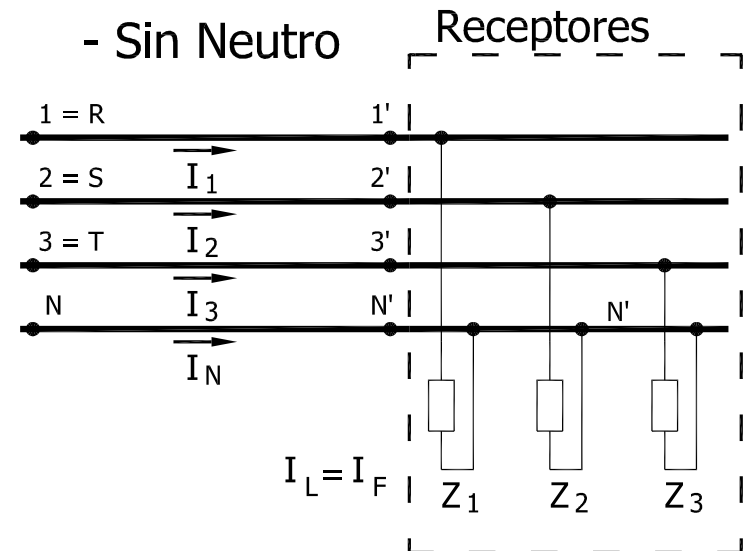
Si $\bar{Z}_{12} = \bar{Z}_{23} = \bar{Z}_{31}$ Carga Equilibrada $I_L = \sqrt{3} I_F$

Si $\bar{Z}_{12} \neq \bar{Z}_{23} \neq \bar{Z}_{31}$ Carga Desequilibrada

Carga Trifásica en ESTRELLA

- Con Neutro

- Sin Neutro



Si $\bar{Z}_1 = \bar{Z}_2 = \bar{Z}_3$ Carga Equilibrada $U_L = \sqrt{3} U_F$

Si $\bar{Z}_1 \neq \bar{Z}_2 \neq \bar{Z}_3$ Carga Desequilibrada

ESTUDIO GENERALIZADO DE LOS SISTEMAS TRIFASICOS

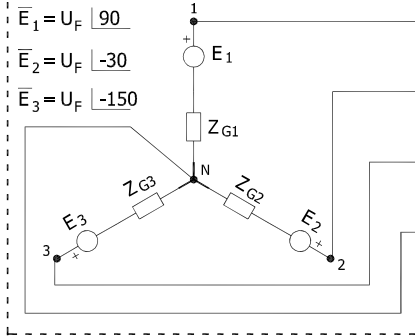
GENERADOR REAL

LÍNEA REAL

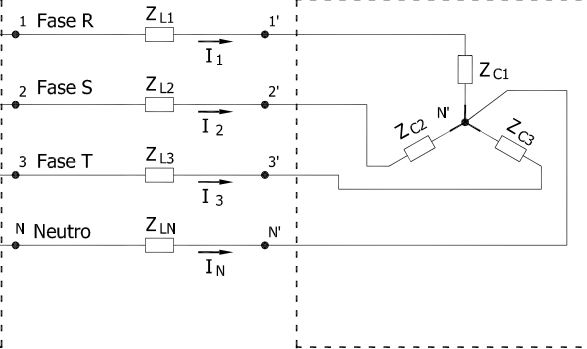
RECEPTOR TRIFÁSICO

SISTEMA ESTRELLA-ESTRELLA

Generador Trifásico en Estrella CON Neutro



Receptor Trifásico en Estrella CON Neutro



$$\bar{Y}_1 = 1 / (\bar{Z}_{G1} + \bar{Z}_{L1} + \bar{Z}_{C1})$$

$$\bar{Y}_2 = 1 / (\bar{Z}_{G2} + \bar{Z}_{L2} + \bar{Z}_{C2})$$

$$\bar{Y}_3 = 1 / (\bar{Z}_{G3} + \bar{Z}_{L3} + \bar{Z}_{C3})$$

$$\bar{U}_{N'N} = \frac{\bar{E}_1 \bar{Y}_1 + \bar{E}_2 \bar{Y}_2 + \bar{E}_3 \bar{Y}_3}{\bar{Y}_1 + \bar{Y}_2 + \bar{Y}_3 + \bar{Y}_N}$$

$$\bar{I}_1 = (\bar{E}_1 - \bar{U}_{N'N}) \bar{Y}_1$$

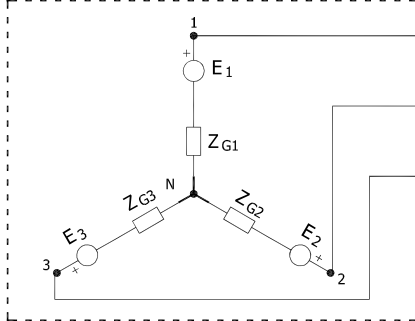
$$\bar{I}_2 = (\bar{E}_2 - \bar{U}_{N'N}) \bar{Y}_2$$

$$\bar{I}_3 = (\bar{E}_3 - \bar{U}_{N'N}) \bar{Y}_3$$

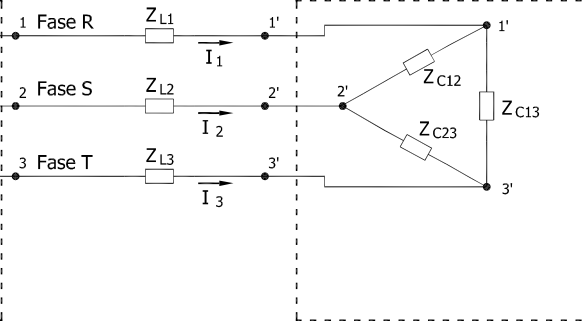
$$\bar{I}_N = -\bar{U}_{N'N} / \bar{Z}_{LN}$$

SISTEMA ESTRELLA-TRIÁNGULO

Generador Trifásico en Estrella SIN Neutro



Receptor Trifásico en Triángulo



$$\bar{Z}_{C1} = \frac{\bar{Z}_{C12} \times \bar{Z}_{C13}}{\bar{Z}_{C12} + \bar{Z}_{C13} + \bar{Z}_{C23}}$$

$$\bar{Z}_{C2} = \frac{\bar{Z}_{C12} \times \bar{Z}_{C23}}{\bar{Z}_{C12} + \bar{Z}_{C13} + \bar{Z}_{C23}}$$

$$\bar{Z}_{C3} = \frac{\bar{Z}_{C23} \times \bar{Z}_{C13}}{\bar{Z}_{C12} + \bar{Z}_{C13} + \bar{Z}_{C23}}$$

EQUIVALE A UN SISTEMA ESTRELLA-ESTRELLA SIN NEUTRO ($\bar{Z}_{LN} = \infty$)

SISTEMA TRIÁNGULO-ESTRELLA

$$\bar{Z}_{G1} = (\bar{Z}_{G13} \bar{Z}_{G12}) / (\bar{Z}_{G12} + \bar{Z}_{G13} + \bar{Z}_{G23})$$

$$\bar{Z}_{G2} = (\bar{Z}_{G12} \bar{Z}_{G23}) / (\bar{Z}_{G12} + \bar{Z}_{G13} + \bar{Z}_{G23})$$

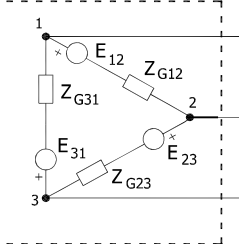
$$\bar{Z}_{G3} = (\bar{Z}_{G23} \bar{Z}_{G13}) / (\bar{Z}_{G12} + \bar{Z}_{G13} + \bar{Z}_{G23})$$

$$\bar{E}_1 = \left(\frac{\bar{E}_{13}}{\bar{Z}_{13}} - \frac{\bar{E}_{31}}{\bar{Z}_{31}} \right) \bar{Z}_{G1}$$

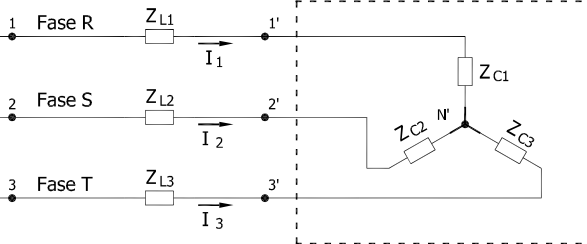
$$\bar{E}_2 = \left(\frac{\bar{E}_{23}}{\bar{Z}_{23}} - \frac{\bar{E}_{12}}{\bar{Z}_{12}} \right) \bar{Z}_{G2}$$

$$\bar{E}_3 = \left(\frac{\bar{E}_{31}}{\bar{Z}_{31}} - \frac{\bar{E}_{23}}{\bar{Z}_{23}} \right) \bar{Z}_{G3}$$

Generador Trifásico en Triángulo



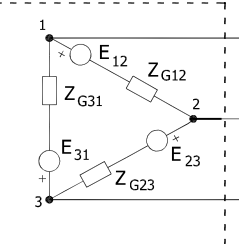
Receptor Trifásico en Estrella SIN Neutro



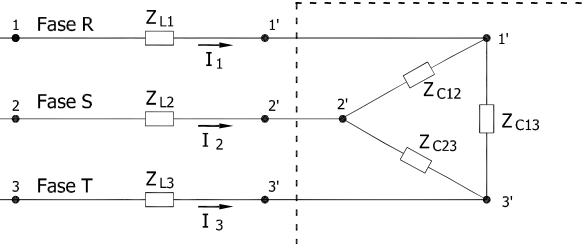
EQUIVALE A UN SISTEMA ESTRELLA-ESTRELLA SIN NEUTRO ($\bar{Z}_{LN} = \infty$)

SISTEMA TRIÁNGULO-TRIÁNGULO

Generador Trifásico en Triángulo

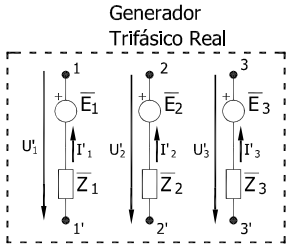


Receptor Trifásico en Triángulo

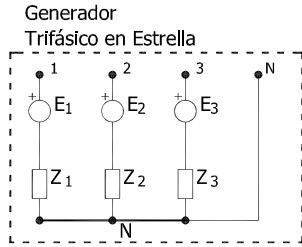


EQUIVALE A UN SISTEMA ESTRELLA-ESTRELLA SIN NEUTRO ($\bar{Z}_{LN} = \infty$)

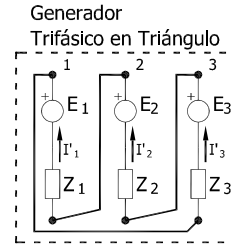
Generador Trifásico Real



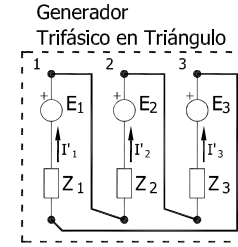
$$\begin{aligned}\bar{U}'_1 &= \bar{U}_{1N} \\ \bar{U}'_2 &= \bar{U}_{2N} \\ \bar{U}'_3 &= \bar{U}_{3N}\end{aligned}$$



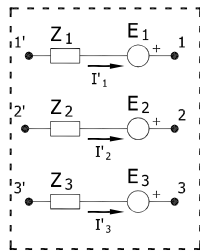
E-1



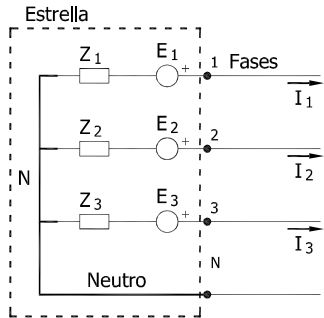
T-1



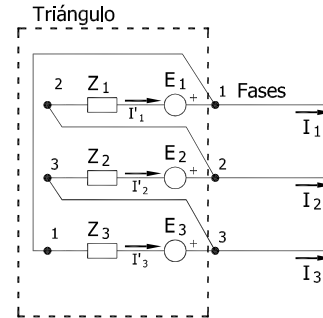
T-4



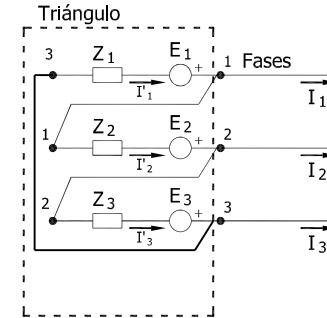
$$\begin{aligned}\bar{U}_{12} &= \bar{U}_{1N} - \bar{U}_{2N} \\ \bar{U}_{23} &= \bar{U}_{2N} - \bar{U}_{3N} \\ \bar{U}_{31} &= \bar{U}_{3N} - \bar{U}_{1N}\end{aligned}$$



E-2



T-2



T-5

Normalmente:

$$|\bar{E}_1| = |\bar{E}_2| = |\bar{E}_3|$$

y desfasados 120°

También:

$$\bar{Z}_1 = \bar{Z}_2 = \bar{Z}_3$$

y como

$$\bar{U}'_1 = \bar{U}_{11'} = \bar{E}_1 - \bar{I}'_1 \bar{Z}_1$$

$$\bar{U}'_2 = \bar{U}_{22'} = \bar{E}_2 - \bar{I}'_2 \bar{Z}_2$$

$$\bar{U}'_3 = \bar{U}_{33'} = \bar{E}_3 - \bar{I}'_3 \bar{Z}_3$$

se tendrá que:

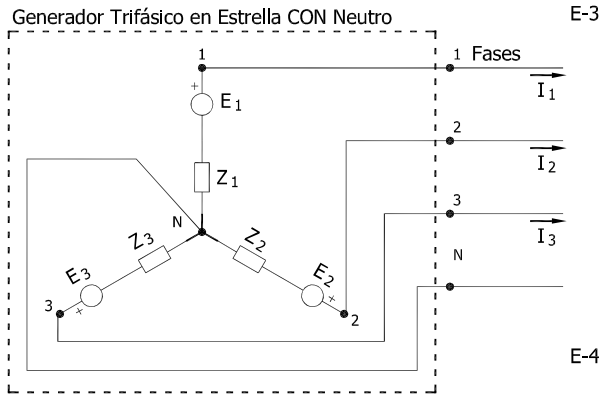
$$|\bar{U}'_1| = |\bar{U}'_2| = |\bar{U}'_3|$$

y desfasados 120°

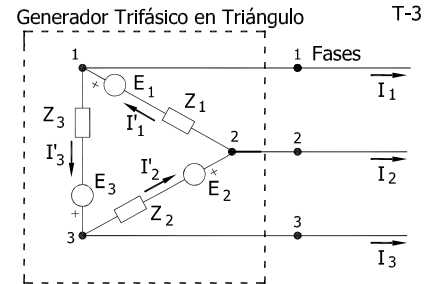
$$\bar{U}'_1 = U_F \angle 90^\circ$$

$$\bar{U}'_2 = U_F \angle -30^\circ$$

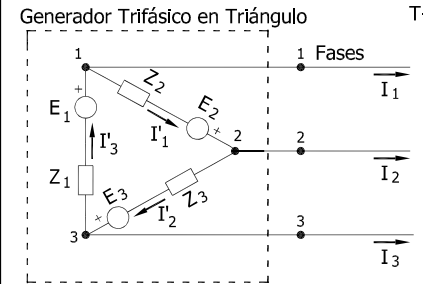
$$\bar{U}'_3 = U_F \angle -150^\circ$$



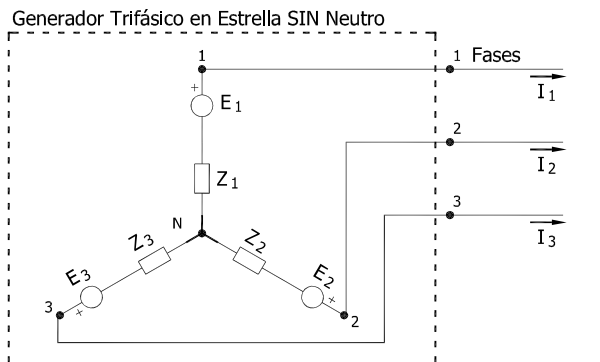
E-3



T-3



T-6



E-4

$$\begin{aligned}\bar{U}_{12} &= \bar{U}_{RS} = \bar{E}_1 - \bar{I}'_1 \bar{Z}_1 = \bar{U}'_1 \\ \bar{U}_{23} &= \bar{U}_{ST} = \bar{E}_2 - \bar{I}'_2 \bar{Z}_2 = \bar{U}'_2 \\ \bar{U}_{31} &= \bar{U}_{TR} = \bar{E}_3 - \bar{I}'_3 \bar{Z}_3 = \bar{U}'_3\end{aligned}$$

$$\begin{aligned}\bar{U}_{12} &= \bar{U}_{RS} = -\bar{E}_2 + \bar{I}'_2 \bar{Z}_2 = -\bar{U}'_2 \\ \bar{U}_{23} &= \bar{U}_{ST} = -\bar{E}_3 + \bar{I}'_3 \bar{Z}_3 = -\bar{U}'_3 \\ \bar{U}_{31} &= \bar{U}_{TR} = -\bar{E}_1 + \bar{I}'_1 \bar{Z}_1 = -\bar{U}'_1\end{aligned}$$