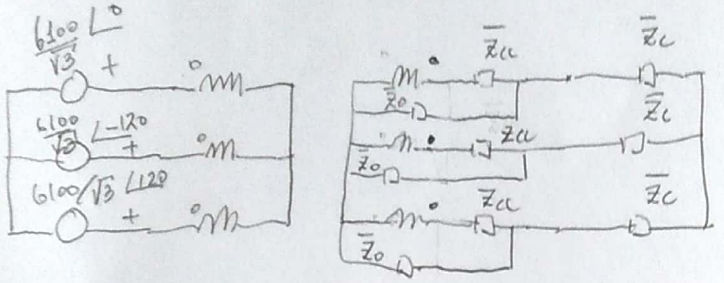
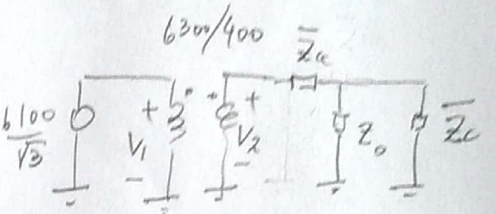
Transformador trifásico (T): $\begin{cases} 6{,}3/0{,}4\ kV & 400\ kVA \\ \text{Ensayo Vacío: } 400V & 20A & 10kW \\ \text{Ensayo c.c.: } 400V & 30A & 12kW \end{cases}$

Red: 6300V, 50Hz — (N) — T → Carga: $\begin{cases} \text{Bajo } 380V \text{ consume } 210\ kW & \cos\varphi = 98\ \text{ind} \end{cases}$

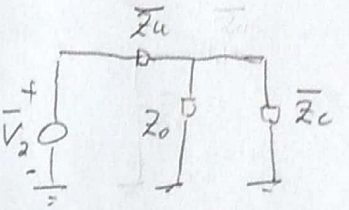
Modelo trifásico de la instalación:



Monofásico ⇒ 90°

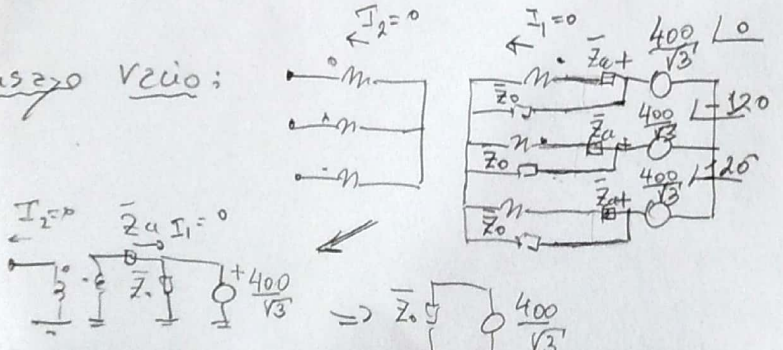


$$\Rightarrow \quad \bar{V}_2 = \bar{V}_1 \cdot \frac{400}{6300} = \frac{6100}{\sqrt{3}} \times \left(\frac{400}{6300}\right) = \frac{387{,}3}{\sqrt{3}}\ V$$



Falta determinar valor de $\bar{Z}_o, \bar{Z}_a, \bar{Z}_c$ } Ensayos

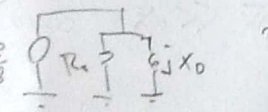
Ensayo vacío:



$P_o = 10.000\ W$

$U_o = 400\ V \Rightarrow$ Alimentado lado de baja tensión.

$I_o = 20A$



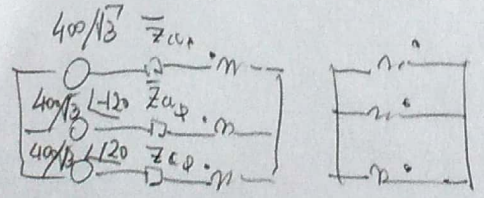
$$P_o = 3 \times \frac{(400/\sqrt{3})^2}{R_o} \Rightarrow R_o = 16\ \Omega$$

$$Q_o = \sqrt{(\sqrt{3} \cdot 400 \cdot 20)^2 - 10000^2} = 9568\ VAR$$

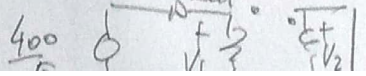
$$Q_o = 3 \times \frac{(400/\sqrt{3})^2}{X_o} \Rightarrow X_o = 16{,}7\ \Omega$$

Ensayo c.c.

$U_{cc} = 400V \Rightarrow$ Alimentado del lado de 6300V pues $U_{cc} \simeq 6\% U_N$

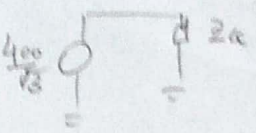


⇒ En el ensayo c.c. la rama de cc No se considera.



$V_2 = 0 \Rightarrow V_1 = 0$

$P_{cc} = 12\,kW \quad I_{cc} = 30\,A.$

$\Rightarrow$ 

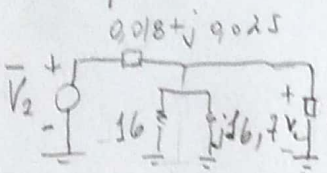
$\Rightarrow \bar{Z}_{ap} = \frac{400/\sqrt{3}}{30} \angle \left(\text{Arcos}\left(\frac{12000}{\sqrt{3}\times 400\times 30}\right)\right) = 7{,}7 \angle 54{,}7°$

$\bar{Z}_{ap} = (4{,}5 + j\,4{,}2)\,\Omega.$

$R_{ap} \qquad X_{ap}$

$\bar{Z}_{ap} = \left(\frac{N_2}{N_1}\right)^2 \bar{Z}_{ap} = \left(\frac{400}{6300}\right)^2 \bar{Z}_{ap} = (0{,}018 + j\,0{,}025)\,\Omega$

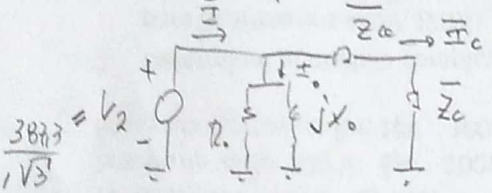
Modelo monofasico y eq de la instalacion



$\bar{Z}_c = \frac{380/\sqrt{3}}{I} \angle \text{Arcos } 0{,}8 \quad \bar{Z}_c = 0{,}55 \angle 36{,}9°$

$I = \frac{210\times 10^3}{\sqrt{3}\times 380\times 0{,}8} = 399{,}3\,A.$

Observar la diferencia de magnitud entre $\bar{z}_0$ y las otras impedancias
Dada esta diferencia y que los calculos se simplifican cuando z_0 queda en paralelo con una fuente se realiza el siguiente cambio:



$\bar{I}_c = \frac{387{,}3/\sqrt{3}}{\bar{Z}_a + \bar{Z}_c} \qquad \bar{Z}_c = 0{,}44 + j\,0{,}33$

$\bar{I}_c = \frac{223{,}9}{0{,}458 + j\,0{,}355} = \frac{223{,}9}{0{,}58 \angle 37{,}8} = 386 \angle -37{,}8°\,A. \quad (= 305 - j\,236)$

$\bar{I}_0 = \frac{223{,}9}{16} - j\frac{223{,}9}{16{,}7} = 14 - j\,13{,}4 = 19{,}4 \angle -43{,}7°$

$\Rightarrow \bar{I} = \bar{I}_0 + \bar{I}_c = 305 - j\,236{,}6 + 14 - j\,13{,}4 = 319 - j\,250 \Rightarrow I = 405{,}3\,A$

¿Cuanto esta cargado el transformador?

$I_{Ns} = \frac{400\times 10^3}{\sqrt{3}\times 400} = 578\,A \Rightarrow \frac{405{,}3}{578} = 0{,}7 \Rightarrow$ carga 70% de su capacidad

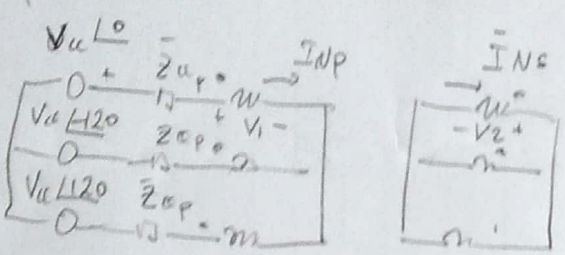
¿Valor de la tension sobre la carga?

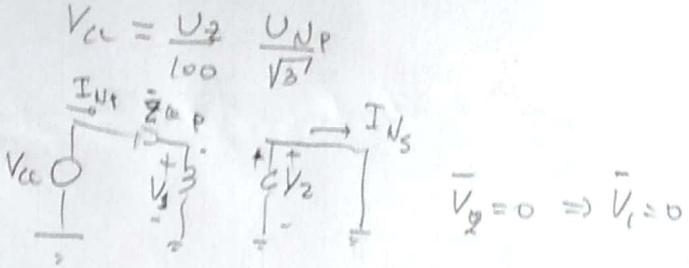
$V_c = 0{,}55 \times 405{,}3 = 222{,}9\,V \Rightarrow U_c = \sqrt{3}\,V_c = 385{,}6\,V$

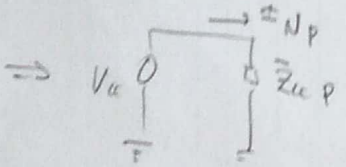
Tensión de cortocircuito U_z

U_z = % de U_N a que hay que alimentar el transformador para que en cortocircuito circule I_N.

Interpretación:







$\Rightarrow V_{cc} = Z_{cp} I_{Np}$ $\quad I_{Np} = \frac{S_N}{\sqrt{3} U_{Np}}$

$\Rightarrow \frac{U_z}{100} \frac{U_{Np}}{\sqrt{3}} = Z_{cp} \frac{S_N}{\sqrt{3} U_{Np}} \Rightarrow \boxed{Z_{cp} = \frac{U_z}{100} \times \frac{U_{Np}^2}{S_N}}$

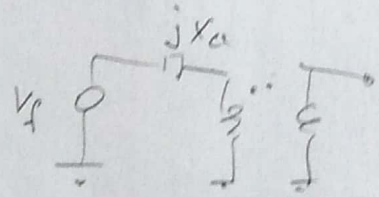
$\bar{Z}_{cs} = \left(\frac{U_{Ns}}{U_{Np}}\right)^2 Z_{cp} = \frac{U_z}{100} \frac{U_{Nc}^2}{S_N}$ #

La fase se debe dar y si no se dice nada se asume $\varphi_{cc} = 90°$ Inductiva pura.

Ejemplo

Trafo: 6300/400 V 500 KVA $U_z = 5\%$

Modelo



$X_{cc} = 0{,}05 \times \frac{6300^2}{500 \times 10^3}$