EJERCICIO 2 Un transformador trifásico conectado en D-Y de 100 kVA, 15.000/380 V, 50 Hz, sometido a los ensayos de vacío y cortocircuito, proporciona los siguientes resultados:

Ensayo de vacío: Po= 1.200 W, Io= 12 A, Uo= 380 V.
Ensayo de cortocircuito: Pcc= 800 W, Icc= 3 A, Ucc= 400 V.

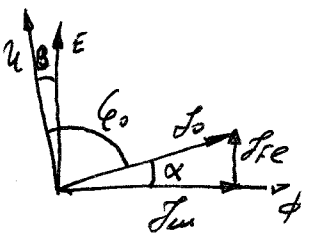
Determinar:
1.- Circuito equivalente referido al lado de AT y referido al lado de BT.
2.- La tensión en el secundario del transformador cuando la carga toma la corriente de régimen con cos φ =0,8 capacitivo. Dibujar el diagrama vectorial correspondiente.

$I_{1nf} = \frac{3,849}{\sqrt{3}} = 2,22\,A$ ($= I'_{2f}$)

1) $S_n = \sqrt{3}\, U_{1n} \cdot I_{1n} \Rightarrow I_{1n} = \frac{S_n}{\sqrt{3}\cdot U_{1n}} = \frac{100.000}{\sqrt{3}\times 15.000} = 3,849\,A$

$P_o = \sqrt{3}\, U_o I_o \cos\varphi_o \Rightarrow \cos\varphi_o = \frac{P_o}{\sqrt{3}\, U_o I_o} = \frac{1.200}{\sqrt{3}\cdot 380\cdot 12} = 0,1519 \Rightarrow \varphi_o = 81,26°$

$\operatorname{sen}\varphi_o = 0,9884$



$P_{fe} = P_{fo} = R_{fe}\cdot I_{fe}^2 = R_{fe}\left(\frac{U_{fo}}{R_{fe}}\right)^2 = \frac{U_{fo}^2}{R_{fe}}$

$R_{fe_{fBT}} = \frac{U_{fo}^2}{P_{fo}} = \frac{\left(\frac{380}{\sqrt{3}}\right)^2}{\frac{1.200}{3}} = 120,33\,\Omega$

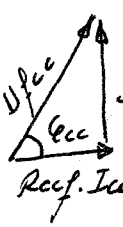
$BT - \lambda \Rightarrow U_{of} = \frac{U_o}{\sqrt{3}}\ ;\ I_{of} = I_o$

$I_{mf} = I_o \operatorname{sen}\varphi_o = 12\times 0,9884 = 11,84\,A$

$X_{mf_{BT}} = \frac{U_{fo}}{I_{mf}} = \frac{\left(\frac{380}{\sqrt{3}}\right)}{11,86} = 18,50\,\Omega$

$P_{cc} = \sqrt{3}\, U_{cc} I_{cc} \cos\varphi_{cc} \Rightarrow \cos\varphi_{cc} = \frac{P_{cc}}{\sqrt{3}\, U_{cc} I_{cc}} = \frac{800}{\sqrt{3}\times 400\times 3} = 0,3849 \Rightarrow \varphi_{cc} = 67,36°$

$\operatorname{sen}\varphi_{cc} = 0,9229$



$R_{ccf}\cdot I_{ccf} = U_{fcf}\cos\varphi_{cc} \Rightarrow R_{ccf} = \frac{U_{ccf}\cdot\cos\varphi_{cc}}{I_{ccf}}$

$X_{ccf}\cdot I_{ccf} = U_{ccf}\cdot\operatorname{sen}\varphi_{cc} \Rightarrow X_{ccf} = \frac{U_{ccf}\cdot\operatorname{sen}\varphi_{cc}}{I_{ccf}}$

$AT \Rightarrow \Delta \Rightarrow U_{ccf} = U_{cc}\ ;\ I_{ccf} = \frac{I_{cc}}{\sqrt{3}}$

$R_{ccf_{AT}} = \frac{400\times 0,3849}{\frac{3}{\sqrt{3}}} = 88,89\,\Omega$

$X_{ccf_{AT}} = \frac{400\times 0,9229}{\frac{3}{\sqrt{3}}} = 213,13\,\Omega$

$r_t = \frac{U_{f_{AT}}}{U_{f_{BT}}} = \frac{15.000}{\frac{380}{\sqrt{3}}} = 68,3$

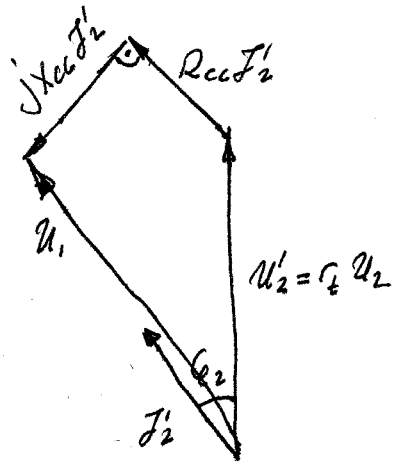
$R_{Fe_{AT}} = R_{Fe_{BT}} \cdot r_t^2 = 120{,}33 \times 68{,}37^2 = 56.247\,\Omega$

$X_{m_{AT}} = X_{m_{BT}} \cdot r_t^2 = 18{,}50 \times 68{,}37^2 = 86.477\,\Omega$

$R_{cc_{BT}} = \frac{R_{cc_{AT}}}{r_t^2} = \frac{88{,}89}{68{,}37^2} = 19 \times 10^{-3}\,\Omega$

$X_{cc_{BT}} = \frac{X_{cc_{AT}}}{r_t^2} = \frac{213{,}13}{68{,}37^2} = 45{,}60 \times 10^{-3}\,\Omega$

2) $AT \Rightarrow \Delta \Rightarrow I_{1f} = \frac{I_{1n}}{\sqrt{3}} = \frac{3{,}849}{\sqrt{3}} = 2{,}22\ A.$



$U_{1f} = U'_{2f} + R_{ccf} I'_{2f} \cdot \cos\varphi_2 - X_{ccf} \cdot I'_{2f} \cdot \operatorname{sen}\varphi_2$

$U'_{2f} = U_{1f} - R_{ccf} \cdot I'_{2f} \cdot \cos\varphi_2 + X_{ccf} \cdot I'_{2f} \cdot \operatorname{sen}\varphi_2$

$U'_{2f} = 15.000 - 88{,}89 \times 2{,}22 \times 0{,}8 + 213{,}13 \times 2{,}22 \times 0{,}6 = 15.126\,\Omega$

$U_{2f} = \frac{U'_{2f}}{r_t} = \frac{15.126}{68{,}37} = 221{,}24\ V.$

$BT \Rightarrow \lambda \Rightarrow U_{2f} = \frac{U_2}{r_t} \Rightarrow U_2 = r_t \cdot U_{2f} = 68{,}37 \times 221{,}24 = 383{,}19\ V$

$383{,}19 > 380 \Rightarrow$ E. Ferranti