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Leg: 13567; Esp: Mecatrónica

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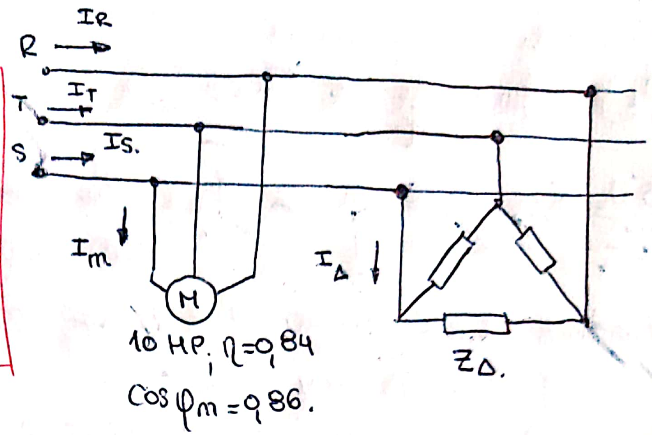
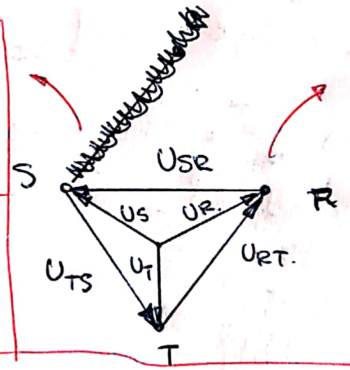
380 V - 50 Hz
secuencia RTS
$P_u = 10\ HP;\ \eta = 0{,}84$
$\cos\varphi_m = 0{,}86.$
$Z_\Delta = 18\,\Omega \angle -20°$
$U_{RS} = 380\,V \angle 0°$



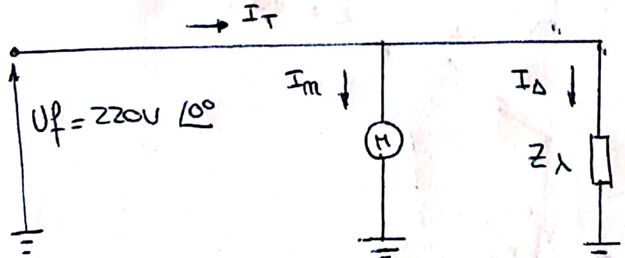
Consideramos el triángulo didáctico.
$-U_{RS} = U_{SR} = 380\,V \angle 180°$

Tensiones de línea:
$U_{RT} = 380\,V \angle 60°$
$U_{TS} = 380\,V \angle -60°$
$U_{SR} = 380\,V \angle 180°$



Tensiones de fase.
$U_R = 220\,V \angle 30°$
$U_S = 220\,V \angle 150°$
$U_T = 220\,V \angle -90°$

* Consideramos el circuito equivalente monofásico.



Hacemos la transformación $\Delta \rightarrow \lambda$.
Luego:
$$Z_\lambda = \frac{Z_\Delta}{3}$$
$$Z_\lambda = \frac{18\,\Omega \angle -20°}{3}$$
$$\boxed{Z_\lambda = 6\,\Omega \angle -20°}$$

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* Corriente de línea del motor.

~~$\sqrt{3}\,U_L I_m = P_m = \frac{P_u}{\eta} \rightarrow I_m = \; P_u$~~

$$\sqrt{3}\, U_L I_m \cdot \cos\varphi_m = \frac{P_u}{\eta} \longrightarrow I_m = \frac{P_u}{\sqrt{3}\, U_L \cos\varphi_m \, \eta}$$

obtenemos $I_m = \dfrac{10\ HP \cdot 746\ W/1HP}{\sqrt{3}\ 380V \cdot 0{,}86 \cdot 0{,}84} = \boxed{15{,}69\ A}$

$\varphi_m = -\cos^{-1} 0{,}86 = \boxed{-30{,}68°} \longrightarrow$ (por ser carga predominantemente inductiva)

Entonces $\boxed{I_m = 15{,}69\ A \angle -30{,}68°}$

· Corriente de la carga en Δ.

$$I_\Delta = \frac{U_f}{Z_\lambda} = \frac{220\ V \angle 0°}{6\ \Omega \angle -20°} = \boxed{36{,}67\ A \angle 20°}$$

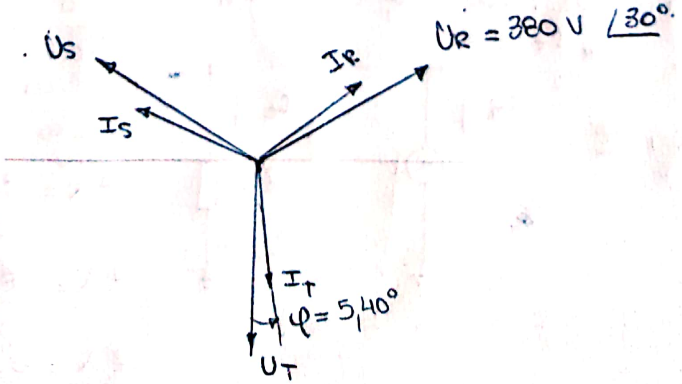
b) $I_L = I_\Delta + I_m = 36{,}67\ A \angle 20° + 15{,}69\ A \angle -30{,}68°$

$\boxed{I_L = 48{,}16\ A \angle 5{,}40°}$ φ

Entonces:

$$\boxed{\begin{aligned} I_R &= 48{,}16\ A \angle 35{,}4° \\ I_S &= 48{,}16\ A \angle 155{,}4° \\ I_T &= 48{,}16\ A \angle 275{,}4° \end{aligned}}$$

c)



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d). $P_m = \frac{P_u}{\eta} = \frac{10\ HP \cdot 746\ W/HP}{0,84} = \boxed{8881\ W}$

$P_\Delta = \sqrt{3}\, U_L \cdot I_\Delta \cdot \cos\varphi_\Delta = \sqrt{3}\ 380V \cdot 36,67A \cdot \cos(20°)$

$\boxed{P_\Delta = 22680\ W}$

$S_m = \sqrt{3}\, U_L \cdot I_m = \sqrt{3} \cdot 380V \cdot 15,69A = \boxed{10327\ VA}$

$S_\Delta = \sqrt{3}\, U_L \cdot I_\Delta = \sqrt{3} \cdot 380V \cdot 36,67A = \boxed{24135\ VA}$

$\cancel{Q_m = S_m \cdot \tan\varphi_m = 10327\ VA \tan 30,68°}$

$\cancel{Q_m = S_m^2 - Q}$

$Q_m = (S_m^2 - P_m^2)^{1/2} = [(10327\ VA)^2 - (8881\ W)^2]^{1/2} = \boxed{5269\ VAR}$

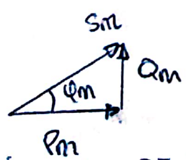
$Q_\Delta = (S_\Delta^2 - P_\Delta^2)^{1/2} = [(24135\ VA)^2 - (22680V)^2]^{1/2} = \boxed{8255\ VAR}$

$P_T = I_L \cdot U_L \cdot \sqrt{3} \cdot \cos\varphi = 48,16A \cdot 380V \sqrt{3} \cdot \cos(5,40°) = \boxed{31557\ W}$

$S_T = I_L\, U_L \sqrt{3} = 48,16\ A \cdot 380V \cdot \sqrt{3} = \boxed{31698\ VA}$

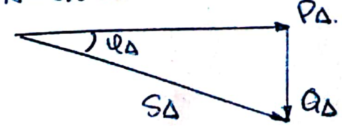
$Q_T = I_L\, U_L \cdot \sqrt{3}\ \mathrm{sen}\,\varphi = 31698\ VA \cdot \mathrm{sen}(5,40°) = \boxed{2983\ VAR}$

e). TRIANGULO DE POTENCIAS DEL MOTOR.



$\varphi_m = 30,68°$

TRIÁNGULO DE POTENCIAS DE LA CARGA EN Δ.



$\varphi_\Delta = -20°$

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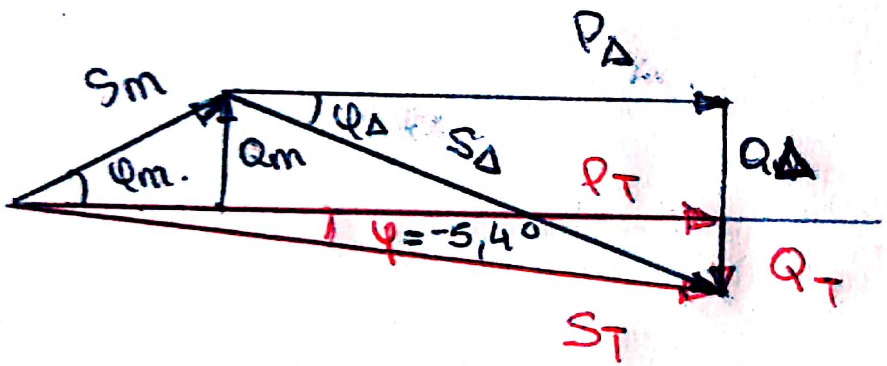
TRIANGULO DE POTENCIA TOTAL.



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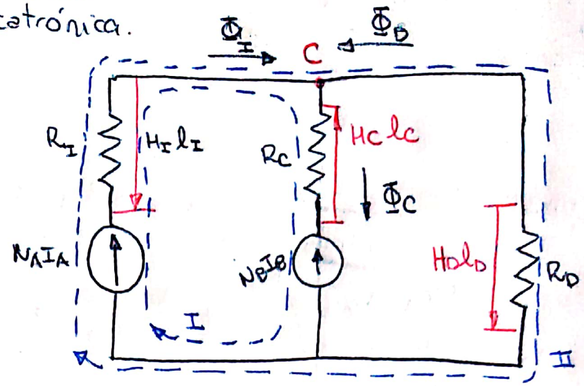
2. $S = 100\,cm^2$
$N_B = 200$
$N_A = 1000$
$I_A = 0{,}5\,A$
$\Phi_C = 0$
$\mu_r = 200$
determinar I_B.



- Aplicamos ley de nodos en el nodo C.

$$\Phi_D + \Phi_I = \Phi_C = 0 \longrightarrow \Phi_D = -\Phi_I \quad (1)$$

Aplicamos ley de mallas a la malla externa (malla II).

$$N_A I_A - H_I l_I + H_D l_D = 0.$$
$$N_A I_A - \Phi_I R_I + \Phi_D R_D = 0.$$
$$N_A I_A = \Phi_I (R_I + R_D).$$
$$\Phi_I = \frac{N_A I_A}{R_I + R_D} \quad (2).$$

- Aplicamos ley de mallas a la malla izquerda (malla I).

$$N_A I_A - N_B I_B - H_I l_I - H_C l_C = 0.$$
$$N_A I_A - N_B I_B - \Phi_I R_I - \cancel{\Phi_C R_C} = 0$$
$$N_A I_A - \Phi_I R_I = N_B I_B.$$
$$I_B = \frac{1}{N_B}\left(N_A I_A - \frac{N_A I_A}{R_I + R_D} \cdot R_I\right) = \frac{N_A I_A}{N_B} \cdot \left(1 - \frac{1}{1 + \frac{R_D}{R_I}}\right) \quad (3)$$

$$R_D = \frac{l_D}{\mu_0 \mu_r \cdot S} = \frac{3l}{\mu_0 \mu_r S} \; ; \quad R_I = \frac{l_I}{\mu_0 \mu_r S} = \frac{3l}{\mu_0 \mu_r S}.$$

Entonces. $R_D / R_I = 1.$

reemplazando en (3) se obtiene:

$$I_B = I_A \frac{N_A}{N_B} \cdot 1/2 = 0{,}5\,A \cdot \frac{1000}{200} \cdot 1/2 = \boxed{1{,}25\,A}$$

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3 a). Vatímetro 1: $\frac{Alc_A \cdot Alc_V}{n^o \text{ divisiones}} = \frac{2{,}5\,A \cdot 240\,V}{150\,div} = \boxed{4\,W/div = K1}$

Vatímetro 2: $\frac{Alc_A \cdot Alc_V}{n^o \text{ divisiones}} = \frac{2{,}5\,A \cdot 300\,V}{65\,div} = \boxed{11{,}54\,W/div} = K2.$

b). Vatímetro 1: $W_1 = k_1 \cdot n^o div. = 4\,\frac{W}{div} \cdot 75\,div = \boxed{300\,W}$

Vatímetro 2: $W_2 = k_2 \cdot n^o div. = 11{,}54\,\frac{W}{div} \cdot 60\,div = \boxed{692{,}31\,W}$

c) $P = W_1 + W_2 = 300\,W + 692{,}31\,W = \boxed{992{,}31\,W}$

d). $Q = \sqrt{3}\,(W_1 - W_2) = \sqrt{3} \cdot (300\,W - 692{,}31\,W) = \boxed{-679{,}5\ VAR.}$

e) $\tan\varphi = \frac{Q}{P} = \frac{-679{,}5}{992{,}31} = -0{,}68 \longrightarrow \boxed{\cos\varphi = 0{,}825}$ – fdp.
↳ en adelanto.