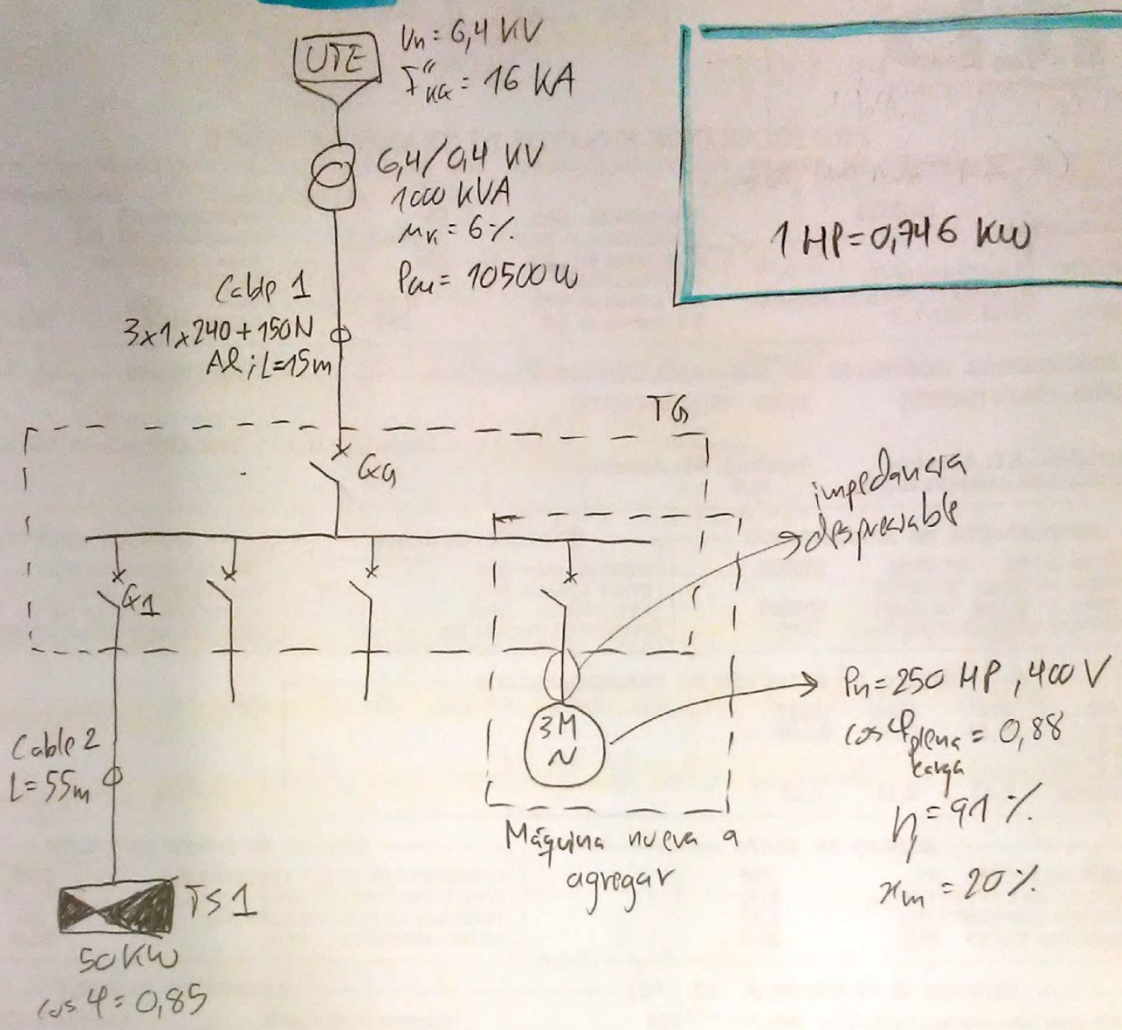
Ejercicio



1 HP = 0,746 kW

a) Red $\quad \underline{Z_{RED} = jX_{RED} = j\cdot\frac{U^2}{S_{cc}} = j\cdot\frac{400^2}{\sqrt{3}\cdot 6,4\cdot 16} = j\cdot 0,9\ m\Omega}$

TRAFO $\quad |Z_T| = u_k\cdot\frac{U^2}{S} = 0,06\cdot\frac{400^2}{1000\times10^3} = 9,6\ m\Omega$

$P_{cu} = 3 R_T \cdot I^2 \longrightarrow R_T = \frac{P_{cu}}{3I^2} = \frac{10.500}{3\cdot 1443,37^2} = 1,68\ m\Omega$

$I = \frac{S_n}{\sqrt{3}\,U_n} = \frac{1000\times10^3}{\sqrt{3}\cdot 400} = 1443,37\ A$

$|Z_T|^2 = R_T^2 + X_T^2 \longrightarrow X_T = \sqrt{|Z_T|^2 - R_T^2} = \sqrt{9,6^2 - 1,68^2} = 9,45$

$\underline{Z_T = 1,68 + j\,9,45\ m\Omega}$

Cable $\quad \underline{Z_{cable1} = R_{c1} + jX_{c1} = 0,160\cdot 0,015 + j\,0,092\cdot 0,015 = 2,4 + j\,1,38\ m\Omega}$

$$I_{cc_{3F}} = \frac{U_n/\sqrt{3}}{|Z_{eq}|} = \frac{400/\sqrt{3}}{12{,}419} = 18{,}60\ KA$$

$$Z_{eq} = Z_{RED} + Z_{TR} + Z_{C1} = j\cdot 0{,}9 + (1{,}68 + j\,9{,}45) + (1{,}24 + j\,1{,}38)$$

$$= 4{,}08 + j\,11{,}73 \longrightarrow |Z_{eq}| = 12{,}419\ m\Omega$$

(b) $PdC_{G_G} = 20\ KA$ ¿Es adecuado? → Sí, porque

$PdC_{G_G} > I_{cc_{3F_{G_G}}}$

(20 KA) (18,6 KA)

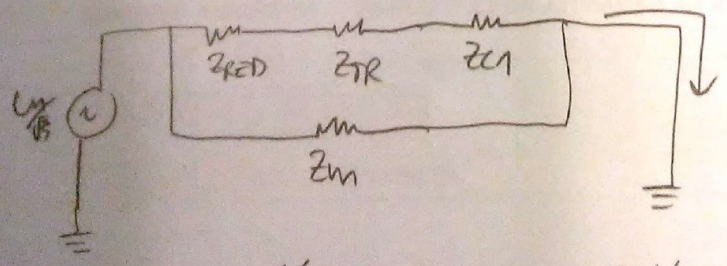
(c) No. La nueva máquina sobe los contactores máximos de las llaves secundarias, excepto la propia de la máquina, pero NO me modifica el ccto máximo en bornes de G_G.

(d) Calculo ccto máximo en bornes de G_1:

$$Z_m = j\cdot x\cdot \frac{U^2}{S} = j\cdot 0{,}2\cdot \frac{400^2}{232{,}89\times 10^3} = j\,137{,}4\ m\Omega$$

$$P_e = \frac{P_m}{\eta} = \frac{250\ HP}{0{,}91} = \frac{250\cdot 0{,}746}{0{,}91} = 204{,}94\ kW$$

$$S = \frac{P}{\cos\varphi} = \frac{204{,}94}{0{,}88} = 232{,}89\ KVA$$



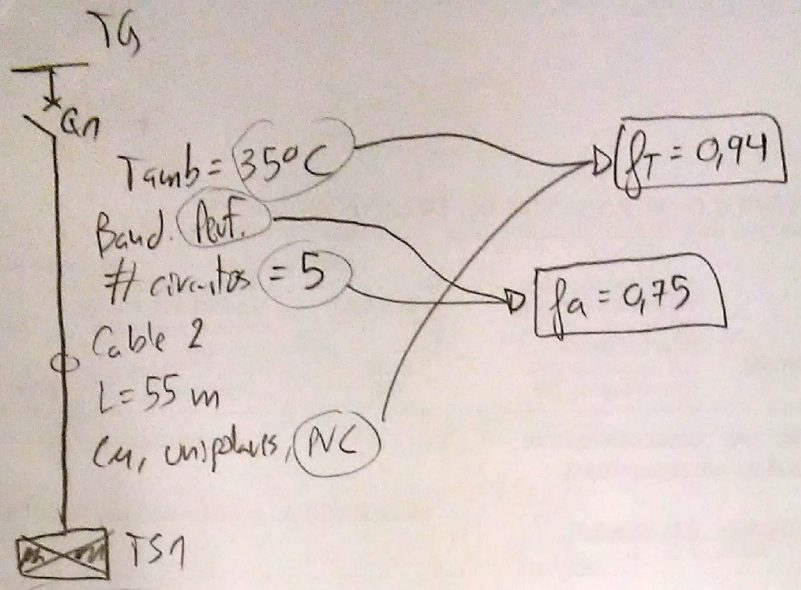
$Z_{eq} = 11{,}438\ m\Omega$

$I_{cc_{3F_{G1}}} = \frac{U_n/\sqrt{3}}{|Z_{eq}|} = \frac{400/\sqrt{3}}{11{,}438} = 20{,}19\ KA$

$(Z_{RED} + Z_{TR} + Z_{C1}) // Z_m = (4{,}08 + j\,11{,}73) // j\,137{,}4 = 3{,}46 + j\,10{,}9$

Es necesario cambiar el interruptor ∴ S

✓ 20 KA



50 kW, $\cos\varphi = 0{,}85$ → $\varphi = 31{,}79°$ → $\operatorname{sen}\varphi = 0{,}53$

↳ $S = \frac{P}{\cos\varphi} = \frac{50 \times 10^3}{0{,}85} = 58{,}823$ KVA → $I_L = \frac{S}{\sqrt{3}.U_n} = 84{,}9$ A

S (mm^2)	I_T	$I_Z = I_0 . \overbrace{f_a . f_T}^{0{,}705}$
25	110	77,55 ✗
35	137	96,59 ✓
50	167	117,74

→ $S_{Tdm} = 35\ mm^2$

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② $\Delta U_{TG-TS1} < 1{,}5\%$

$\rho = 0{,}0222\ \Omega mm^2/m$

$x_L = 0{,}09\ m\Omega/m$

$\Delta U = \sqrt{3}\, I_d . (R_T . \cos\varphi + X_T . \operatorname{sen}\varphi)$

$= \sqrt{3}. I_d \left(\frac{\rho L}{S} . \cos\varphi + x . L . \operatorname{sen}\varphi\right)$

$= \sqrt{3}. 84{,}9 \left(\frac{0{,}0222}{35} . 55 . 0{,}85 + 0{,}09 \times 10^{-3} . 55 . 0{,}53\right)$

$= 4{,}75\ V \rightarrow \frac{\Delta U}{U_n} \times 100 = 1{,}18\% < 1{,}5\%$ ∴ No es necesario modificar la sección

$I_{cc3F_{G1}} = 20,19\ KA$

$I_L < I_r < I_z$

$I_L = 84,9\ A$ $\quad$ $I_z = 96,59$

Caso dado $I_n = 100\ A \longrightarrow$

$\times 1,\ I_r = 100\ A$

$\times 0,95,\ I_r = 95\ A$

$\times 0,90,\ I_r = 90\ A$

$\times 0,85,\ I_r = 85\ A$

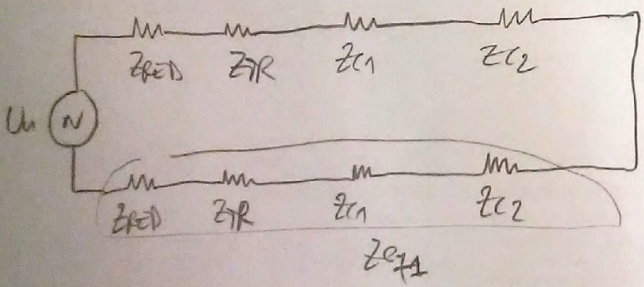
$\times 0,8,\ I_r = 80\ A$

→ Dado ajustado G_1 $I_r = 90\ A$

(h) Hallo cto mínimo asociado a Q_1:

cto 2F

$$I_{cc_{2F}} = \frac{U_n}{2|Z_{eqv_1}|} = \frac{400}{2 \cdot 34,88} = 5,73\ KA$$



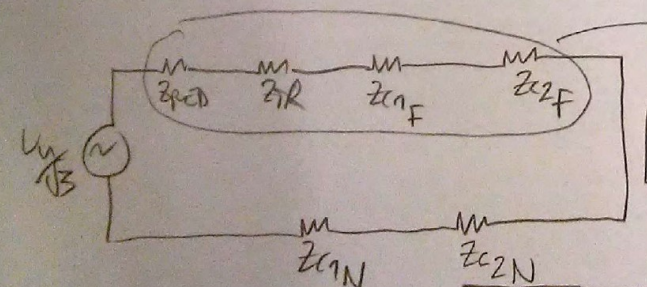
$I_{cm} < 2,85\ kA$

$Z_{eqv_1} = 4,08 + j\,11,73 + \left(\frac{\rho L}{S} + j\,x \cdot L\right) = 38,96 + j\,16,68\ m\Omega$

$|Z_{eqv_1}| = 42,38\ m\Omega$

$\frac{0,0222 \cdot 55}{35} = 34,88\ m\Omega$ $\quad$ $j\,0,09 \times 10^{-3} \cdot 55 = j\,4,95\ m\Omega$

cto F-N



$Z_{eqv_1} = 38,96 + j\,16,68$

$Z_{eq.TOT} = Z_{eqv_1} + Z_{C1_N} + Z_{C2_N}$

$= (38,96 + j\,16,68) + (3,96 + j\,1,455) + (34,88 + j\,4,95) = 77,8 + j\,23,09\ m\Omega$

$Z_{eqv_{TOT}} = 81,15\ m\Omega$

$Z_{C1_N} = 0,264 \cdot 0,015 + j \cdot 0,097 \cdot 0,015 = 3,96 + j\,1,455\ m\Omega$

$Z_{C2_N} = Z_{C2_F} = 34,88 + j\,4,95\ m\Omega$

$I_{cc_{FN}} = \frac{U_n/\sqrt{3}}{|Z_{eqv_{TOT}}|} = 2,85\ KA$