TE – 20160623 – 1

① $W_p = \int_{6h}^{18h} p_p(t)\,dt = \int_{6h}^{9h} p_p(t)\,dt + \int_{9h}^{15h} p_p(t)\,dt + \int_{15h}^{18h} p_p(t)\,dt$

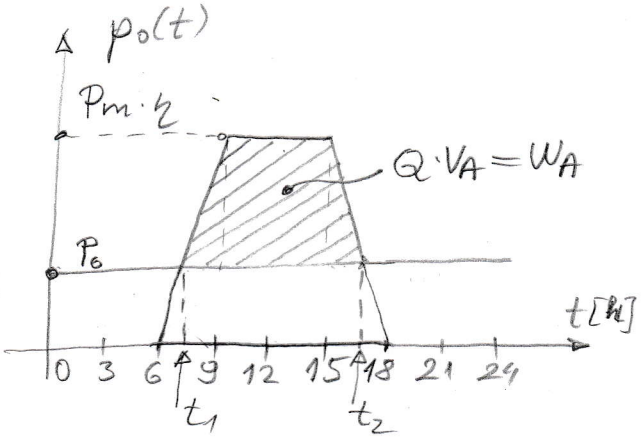
$= \frac{3\cdot 500}{2} + 6\cdot 500 + \frac{3\cdot 500}{2} = \underline{4500\ Wh}.$

$W_o = \eta \cdot W_p = 0{,}9 \cdot 4500 = \underline{4050\ Wh}.$

$P_o = \frac{W_o}{24h} = \frac{4050}{24} = \underline{168{,}75\ W}$

$W_A = Q V_A = \int_{t_1}^{t_2} (p_o(t) - P_o)\,dt$

$W_A = \int_{t_1}^{9h} (p_o - P_o)\,dt + \int_{9}^{15h} (p_o - P_o)\,dt + \int_{15h}^{t_2} (p_o - P_o)\,dt.$



$t_1 - 6 = \frac{P_o}{P_m \cdot \eta} \cdot 3 = \frac{168{,}75 \cdot 3}{500 \cdot 0{,}9} = 1{,}125h \Rightarrow t_1 = \underline{7{,}125h}.$

$t_2 = 18 - (t_1 - 6) = 18 - 1{,}125 = \underline{16{,}875h}$

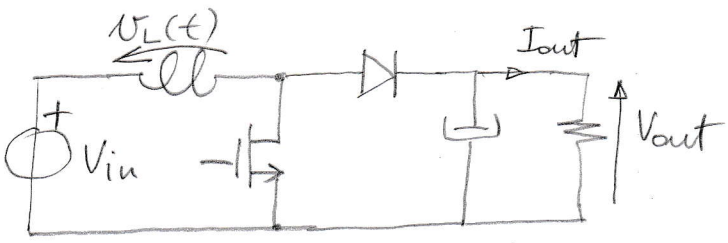
$W_A = \frac{9 - t_1}{2} \cdot (P_m \cdot \eta - P_o) + (15 - 9)(P_m \cdot \eta - P_o) + \frac{t_2 - 15}{2} \cdot (P_m \cdot \eta - P_o)$

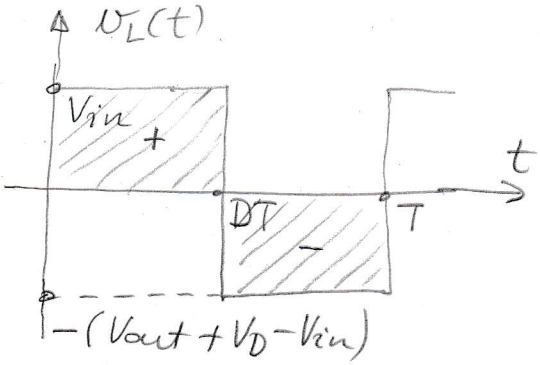
$W_A = \frac{1{,}875}{2}(500 \cdot 0{,}9 - 168{,}75) + 6 \cdot (500 \cdot 0{,}9 - 168{,}75) + \frac{1{,}875}{2}(500 \cdot 0{,}9 - 168{,}75)$

$W_A = 263{,}7 + 1687{,}5 + 263{,}7 = \underline{2215\ Wh}$

$Q = \frac{W_A}{V_A} = \frac{2215}{24} = \underline{92{,}3\ Ah}.$

②





a) $V_{in} \cdot DT = (V_{outa} + V_D - V_{in})(1 - D)T$

$V_{outa} = V_{in}\frac{D}{1-D} + V_{in} - V_D = V_{in}\frac{1}{1-D} - V_D$

$V_{outa} = 12 \cdot \frac{1}{1-0{,}5} - 1 = 24 - 1 = \underline{23V}$

b) $\left(V_{in} - I_{in} \cdot r_{Dson}\right) DT = (V_{outb} + V_D - V_{in})(1-D)T$

$I_{in}(1-D) = I_{out}$

$\left(V_{in} - \frac{I_{out}}{1-D} \cdot r_{Dson}\right) D = (V_{outb} + V_D - V_{in})(1-D)$

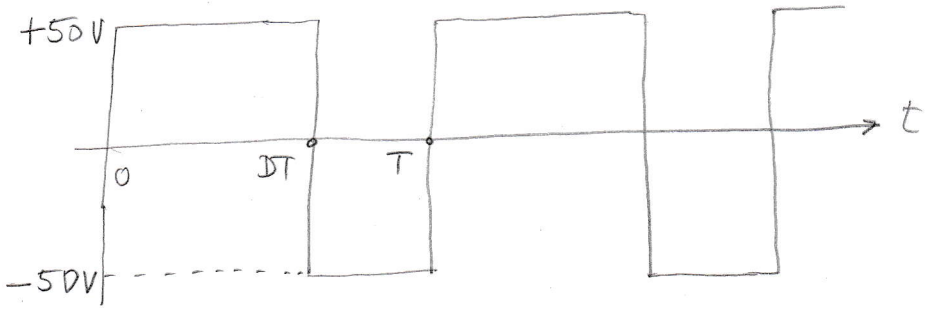
$V_{outb} = 0{,}97 \cdot V_{outa} = \underline{22{,}31\ V}$; $r_{Dson} = ?$

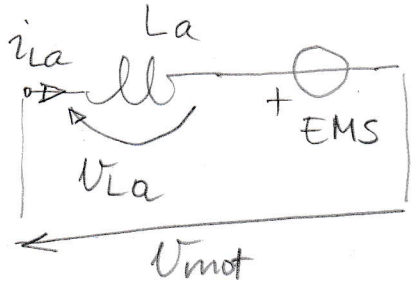
$$V_{in} - \frac{I_{out}}{1-D} r_{DSon} = (V_{out5} + V_D - V_{in}) \frac{1-D}{D}$$

$$r_{DSon} = \frac{1-D}{I_{out}} \left[V_{in} - \frac{1-D}{D} (V_{out5} + V_D - V_{in}) \right]$$

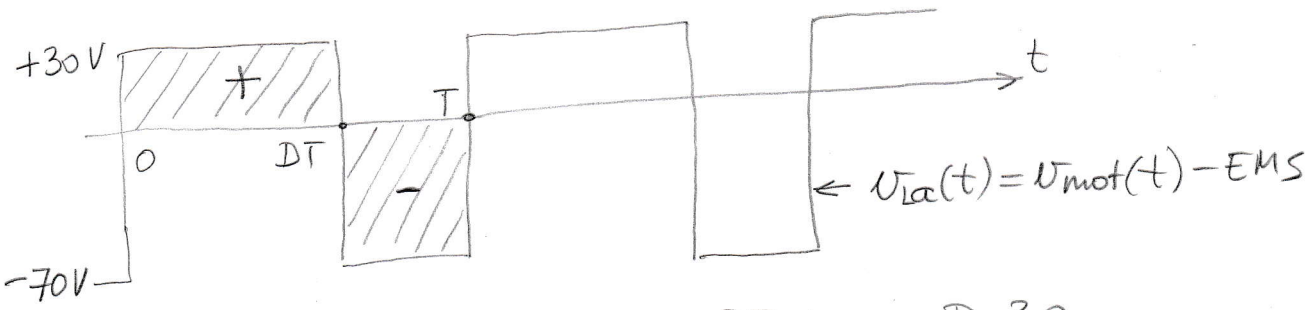
$$r_{DSon} = \frac{0,5}{25} \left[12 - (22,31 + 1 - 12) \right] = \underline{13,8\ m\Omega}$$

(3)





$$EMS = \overline{v_{mot}(t)} = 50 \cdot 0,7 - 50 \cdot 0,3 = \underline{20\ V}$$



$$\Delta I_{La} = \frac{DT \cdot 30}{La} \Rightarrow La = \frac{DT \cdot 30}{\Delta I_{La}} = \frac{D \cdot 30}{f \cdot \Delta I_{La}}$$

$$La = \frac{0,7 \cdot 30}{6 \cdot 10^3 \cdot 12} = \underline{291,7\ \mu H}$$

$$f = \frac{D \cdot 30}{La \cdot \Delta I_{La2}} = \frac{0,7 \cdot 30}{291,7 \cdot 10^{-6} \cdot 2} = \underline{36\ kHz}$$