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Ciclo Diesel Dual.

$$P_3/P_1 = 70$$

$C_{10}H_{21}$

$$\phi = 0,7$$

$$r_{12} = 18$$

$$T_1 = 290K$$

$$P_1 = 85.000 Pa$$

(A) Compresión isentrópica.

$$T_2 = T_1 r_{12}^{\gamma_{12}-1}$$

$\gamma_{12}$ : es del aire

(sólo comprime aire).

$$\bar{C}_{p12} = \gamma_{12}$$

$$\bar{C}_{v12}$$

$$\bar{C}_{p12} = C_{p\text{aire}}$$

$$\frac{T_1+T_2}{2}$$

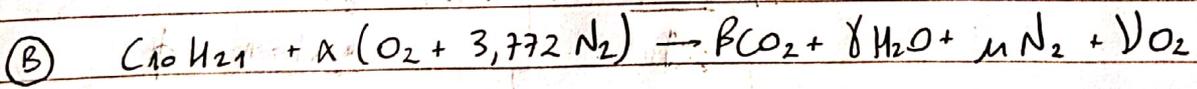
$$\bar{C}_{p12} - 8,314472 = \bar{C}_{v12}$$

$\gamma_{12}$	$T_2 (K)$	$T_m (K)$	$\bar{C}_{p12} (J/molK)$	$\bar{C}_{v12} (J/molK)$	$\gamma_{12}^*$
1,4	921,52	605,8	30,482	22,168	1,375
1,375	857,5	573,7	30,265	21,951	1,379
1,379	866,7	578,4	30,296	21,982	1,378

⇒

$$T_2 = 866,7 K$$

$$\gamma_{12} = 1,378$$



$$10 = \beta$$

$$21 = 2\gamma \Rightarrow \gamma = 10,5$$

$$2\alpha = 2\beta + \gamma + 2\nu \Rightarrow \nu = 6,54$$

$$\alpha \cdot 3,772 = \mu \Rightarrow \mu = 82,18$$

$$2\alpha\gamma = 2\beta + \gamma \Rightarrow \alpha\gamma = 15,25$$

$$\alpha = \frac{\alpha\gamma}{\gamma} \Rightarrow \alpha = 21,79$$

$\phi$

$$y_{CO_2} = \frac{\beta}{\beta + \gamma + \mu + \nu} \Rightarrow y_{CO_2} = 0,0916$$

$$y_{H_2O} = \frac{\gamma}{\beta + \gamma + \mu + \nu} \Rightarrow y_{H_2O} = 0,0961$$

$$y_{N_2} = \frac{\mu}{\beta + \gamma + \mu + \nu} \Rightarrow y_{N_2} = 0,7524$$

$$y_{O_2} = \frac{\nu}{\beta + \gamma + \mu + \nu} \Rightarrow y_{O_2} = 0,0599$$

$$PM_F = 10 \times 12 + 21 \cdot 1 = 141 \text{ g}_{\text{fuel}}$$

mol fuel

$$\text{base de air} : 4,772 \frac{\text{mol air}}{\text{mol O}_2} \cdot \alpha \frac{\text{mol O}_2}{\text{mol fuel}} \Rightarrow PM_{\text{air}}$$

$$PM_a = 2 \times 16 + 2 \times 3,772 \times 14 = 28,84 \text{ g}_{\text{air}}$$

4,772

mol air

$$\frac{MF}{M_a} = \frac{141 \text{ g}_{\text{fuel}} / \text{mol fuel}}{(4,772 \cdot \alpha \frac{\text{mol air}}{\text{mol fuel}}) (28,84 \frac{\text{g}_{\text{air}}}{\text{mol air}})} = 0,047 \frac{\text{kg}_{\text{fuel}}}{\text{kg}_{\text{air}}}$$

$$M_a = (4,772 \cdot \alpha \frac{\text{mol air}}{\text{mol fuel}}) (28,84 \frac{\text{g}_{\text{air}}}{\text{mol air}})$$

$$\phi = \frac{MF}{M_a} \Rightarrow \phi_g = 0,0672$$

$\phi_g$

③ Combustion adiabatic.

$$(m_F + m_a) u_4 - m_a u_2 = -P_3 (V_4 - V_3) + m_F h_F$$

$$\Rightarrow h_4(T) \approx \frac{1}{1 + \phi_{rg}} \left( u_2 + P_3 \cdot \left( \frac{P_3}{P_1} \right) u_2 \right) + \frac{\phi_{rg}}{1 + \phi_{rg}} Q_p^i$$

$$Q_p^i = 6.420.897,36 \text{ kJ/kmol}_F \rightarrow \text{Table.}$$

$$T_2 = 866,7 \text{ K} \Rightarrow u_2 = 19.337,3 \text{ kJ/kmol}_{\text{air}}$$

$$R_u = R = 8,314472 \text{ J} = 288,297 \text{ J}$$

$$P_{M_2} = 28,84 \text{ g} \cdot \text{K} \quad \text{kg} \cdot \text{K}$$

$$u_1 = \frac{R_u T_1}{P_1} = 0,9836 \text{ m}^3; \quad u_2 = \frac{u_1}{\phi_{\text{air}}} \Rightarrow u_2 = 0,0546 \text{ m}^3$$

$$\Rightarrow h_4(T) \approx \frac{1}{1 + \phi_{rg}} \left[ 19.337,3 \frac{\text{kJ}}{\text{kmol}_{\text{air}}} \times 4,772 \frac{\text{kmol}_{\text{air}}}{\text{kmol}_F} + 85 \text{ kPa} \cdot \frac{P_3}{P_1} \cdot 0,0546 \text{ m}^3 \cdot \left( \frac{1}{\phi_{\text{air}}} \right) \frac{\text{kg}_{\text{air}}}{\text{kg}_{\text{fuel}}} \right]$$

$$= \frac{114,1}{1 + \phi_{rg}} \frac{\text{kJ}}{\text{kmol}_F} + \frac{\phi_{rg}}{1 + \phi_{rg}} Q_p^i$$

$$\Rightarrow h_4(T) \approx 3.139.687 \frac{\text{kJ}}{\text{kmol}_F} = 3139,687 \frac{\text{kJ}}{\text{mol}_F}$$

$$\Rightarrow T_4 \approx 5340 \text{ K} \rightarrow \text{Table C10 K21}$$

①  $\beta = V_4/V_3$

$\delta_{4,5} = \frac{C_{p_{4,5}}(T_4+T_5)}{C_{v_{4,5}} \left| \frac{T_4+T_5}{2} \right.}$  7.7

$R_b = \frac{R}{P_{M6}}$

$\Rightarrow R_b = 289,257 \frac{J}{K}$

$P_{M6} = P_{N_{O_2}} \gamma_{O_2} + \dots + P_{N_2} \gamma_{N_2} = 28,7442 \text{ g/mol}$

$P_4 = P_3 = P_1 \cdot 70$

$\rightarrow N_4 =$

$N_4 = \frac{R_b \cdot T_4}{P_4}$

$N_3 = N_2 =$

$m^3 / \text{kg}_{\text{fuel}}$

$\beta = ??$

$T_5 = T_4 \cdot \left( \frac{\beta}{r_{12}} \right)^{\delta_b - 1}$  (i)

$\bar{C}_{v_{4,5}} = \bar{C}_{p_{4,5}} - 8,314472$  (ii)

$\bar{C}_{p_{4,5}} = \gamma_{CO_2} C_{p_{CO_2}} \left| \frac{T_4+T_5}{2} \right. + \dots + \gamma_{N_2} C_{p_{N_2}} \left| \frac{T_4+T_5}{2} \right.$  (iii)

$\delta_b$	$T_5 (K)$	$T_m (K)$	$C_{p_{CO_2}}$	$C_{p_{H_2O}}$	$C_{p_{O_2}}$	$C_{p_{N_2}}$	$\bar{C}_{p_{4,5}}$	$\bar{C}_{v_{4,5}}$	$\delta_b^*$

## Proceso 4-5

Análogo al ciclo Otto pero cambia la relación de expansión:

$$\bar{\gamma}_b = \frac{R_b}{c_v(\bar{T})}$$

?

$$\bar{\gamma}_b = \frac{R_b + c_p(\bar{T})}{c_v(\bar{T})}$$

$$T_4 = T_5 r_e^{\bar{\gamma}_b - 1} = T_5 \left( \frac{V_5}{V_4} \right)^{\bar{\gamma}_b - 1}$$

$$T_5 = T_4 \left( \frac{V_4}{V_5} \right)^{\bar{\gamma}_b - 1} = T_4 \left( \frac{V_3 V_4}{V_5 V_3} \right)^{\bar{\gamma}_b - 1}$$

$$T_5 = T_4 \left( \frac{\beta}{r} \right)^{\bar{\gamma}_b - 1}$$

(E) Equation:

$$\eta_{AF} = \frac{r_p T_1}{Q_i \phi_{19}} \left[ R_2 \left( \frac{\beta - 1}{r} \right) + \frac{R_2}{1 - \delta_6} \left( \frac{\beta}{r} \right) \left[ \left( \frac{\beta}{r} \right)^{\delta_6 - 1} - 1 \right] + \frac{C_{V2}}{r_p} (1 - r^{\delta_6 - 1}) \right]$$