ภาคผนวก ฉ

ตัวอย่างการคำนวณ

1. การคำนวณหาค่าสัมประสิทธิ์การถ่ายเทความร้อนรวม

$$\dot{Q}_{hw} = \dot{m}_{hw} c_{p,hw} (T_{hw,i} - T_{hw,o}) \quad \text{(ฉ.1)}$$

$$\dot{Q}_{hw} = (0.059 \frac{kg}{s})(4.19 \frac{kJ}{kg \cdot K})(95 - 52)^{o}C$$

$$\dot{Q}_{hw} = 10.6 \ kW$$

$$\Delta T_1 = T_{hw,i} - T_{a,i} \quad \text{(ฉ.2)}$$

$$\Delta T_1 = (95 - 56)^{o}C$$

$$\Delta T_1 = 39 \ ^{o}C$$

$$\Delta T_2 = T_{hw,o} - T_{amb} \quad \text{(ฉ.3)}$$

$$\Delta T_2 = (52 - 27.9)^{o}C$$

$$\Delta T_2 = 24.1 \ ^{o}C$$

$$\Delta T_{lm,CF} = \frac{\Delta T_1 - \Delta T_2}{\ln(\Delta T_1 / \Delta T_2)} \quad \text{(ฉ.4)}$$

$$\Delta T_{lm,CF} = \frac{(39 - 24.1)^{o}C}{\ln(39 / 24.1)}$$

$$\Delta T_{lm,CF} = 31 \ ^{o}C$$

$$P = \frac{t_2 - t_1}{T_1 - t_1} \quad \text{(ฉ.5)}$$

$$P = \frac{52 - 95}{27.9 - 95}$$

$$P = 0.64$$

$$R = \frac{T_1 - T_2}{t_2 - t_1} \quad \text{(ฉ.6)}$$

$$R = \frac{27.9 - 56}{52 - 95}$$

$$R = 0.65$$

$$\therefore\ F = 0.87$$

$$U = \frac{\dot{Q}_{hw}}{A_s F \Delta T_{lm,CF}} \quad \text{(ฉ.7)}$$

$$U = \frac{(10.6\,kW)}{(8\,m^2)(0.87)(31\,^oC)}$$

$$\therefore U = 49.2\ W/m^2 \cdot K$$

2. ประสิทธิภาพหัวเผาแก๊ส

$$\eta_b = \frac{\dot{Q}_{out}}{\dot{Q}_{in}} \times 100 \quad \text{(ฉ.8)}$$

$$\eta_b = \frac{\dot{m}_w c_{p,w} (T_{w,o} - T_{w,i})}{\dot{m}_{lpg} \cdot LHV_{lpg}} \times 100 \quad \text{(ฉ.9)}$$

$$\eta_b = \frac{(0.059\frac{kg}{s})(4.19\frac{kJ}{kg\cdot K})(95-52)^oC}{(0.00026\frac{kg}{s})(46.6\frac{MJ}{kg})}\times 100$$

$$\eta_b = 87.5\ \%$$

3. ประสิทธิผลของอุปกรณ์แลกเปลี่ยนความร้อน

$$\varepsilon = \frac{\dot{Q}_{out}}{\dot{Q}_{in}} \qquad \text{(จ.10)}$$

$$\varepsilon = \frac{\dot{m}_a c_{p,a}(T_{a,i} - T_{amb})}{\dot{m}_{hw} c_{p,hw}(T_{hw,i} - T_{hw,o})} \qquad \text{(จ.11)}$$

$$\varepsilon = \frac{(0.331\frac{kg}{s})(1.008\frac{kJ}{kg\cdot K})(56-27.9)^oC}{(0.059\frac{kg}{s})(4.19\frac{kJ}{kg\cdot K})(95-52)^oC}$$

$$\varepsilon = 0.89$$

4. ประสิทธิภาพเชิงความร้อนของการสร้างลมร้อน

$$\eta_{th} = \frac{\dot{Q}_{out}}{\dot{Q}_{in}}\times 100 \qquad \text{(จ.12)}$$

$$\eta_{th} = \frac{\dot{m}_a c_{p,a}(T_{a,i} - T_{amb})}{\dot{m}_{lpg}\cdot LHV_{lpg}}\times 100 \qquad \text{(จ.13)}$$

$$\eta_{th} = \frac{(0.331\frac{kg}{s})(1.008\frac{kJ}{kg\cdot K})(56-27.9)^oC}{(0.00026\frac{kg}{s})(46.6\frac{MJ}{kg})}\times 100$$

$$\eta_{th} = 77.4\ \%$$

5. ความชื้นมาตรฐานเปียก

$$M_w = \frac{(w-d)\times 100}{w} \qquad \text{(ฉ.11)}$$

$$M_w = \frac{(11.3-10.62)kg}{(11.3kg)}\times 100$$

$$M_w = 6.4\ \%\ w.b.$$

6. อัตราการอบแห้ง

$$DR = \frac{m_w}{t} \qquad \text{(ฉ.12)}$$

$$DR = \frac{(60-11)\,kg}{18\,h}$$

$$DR = 2.72\ kg\ water\ evap./h$$

7. การคำนวณการสิ้นเปลืองพลังงานจำเพาะ

$$SEC = \frac{(m_{LPG}\cdot LHV_{LPG}) + P_{elec}}{m_w} \qquad \text{(ฉ.13)}$$

$$SEC = \frac{\left((13.9\,kg)(46.6\frac{MJ}{kg})\right) + \left((20.3\,kWh)(3600\frac{s}{h})(2.5)\right)}{(60-11)\,kg\ water\ evap.}$$

$$SEC = 16.94\,MJ\ /\ kg\ water\ evap.$$