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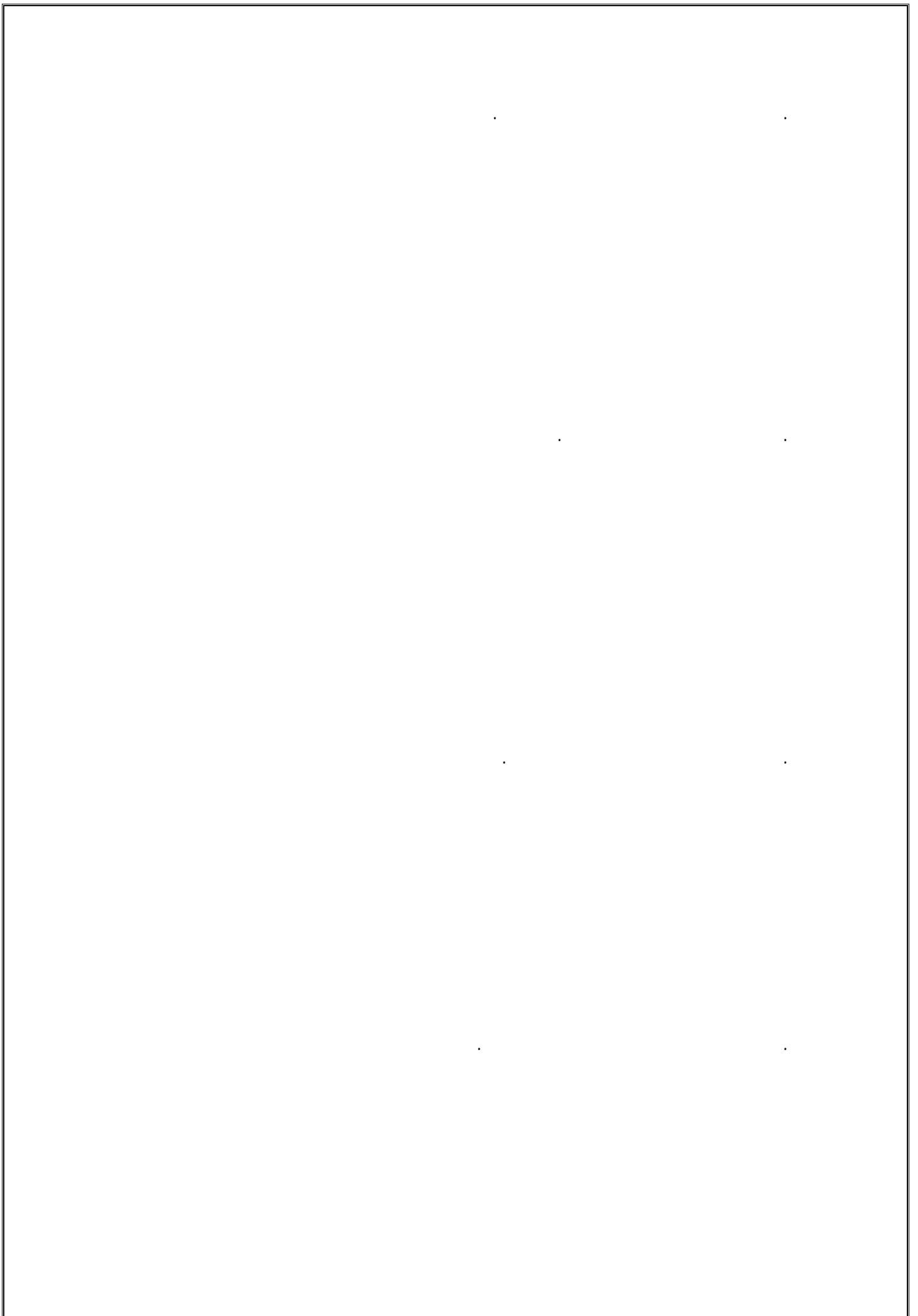
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ارث: حساب التمهيد المبني للكمون

المضخة

$n = 20 \text{ Year}$     $u_L = 15 \text{ year}$     $\therefore n > u_L$

مدى استبدال  $N = \frac{n}{u_L} - 1 = \frac{20}{15} - 1 = 0.33 = 1$  after 15 year

~~$(8000 - 800) \frac{(1.10)^{20} - 1}{0.10} = 5602 \text{ SR}$~~     ~~$P_w = I_c - (I_c - S_v) \left( \frac{1+r}{1+r} \right)^{u_L} - r \left( \frac{1+r}{1+r} \right)^{u_L} = 8000 - (8000 - 800) \left( \frac{1+0.08}{1+0.10} \right)^{15} = 8000$~~

$5602 \left( \frac{1.08}{1.10} \right)^{20} = 9586 \text{ SR}$   
المجموع

$= 3584 \text{ SR}$

المتبقي

$\frac{20000 - 2000}{0.10} \frac{20}{1.10} = 8000 \text{ SR}$

المجموع  $P_w = I_c - S_v \left( \frac{1+r}{1+r} \right)^n = 20000 - 8000 \left( \frac{1.08}{1.10} \right)^{20} = 14457 \text{ SR}$

حساب التكاليف التآزرية  $CRF = \frac{i(1+i)^n}{(1+i)^n - 1} = \frac{0.10(1.10)^{20}}{(1.10)^{20} - 1} = \frac{0.6727}{6.727 - 1} = 0.117$

التكاليف التشغيلية  $FC = \sum P_w \times CRF = (9586 + 3584 + 14457) \times 0.117 = 3232.4 \text{ SR/year}$

التكاليف التشغيلية التآزرية:  $\text{Cost operation} = \text{BHP} \times T \times \text{cost one hr} = 8 \times 1000 \times 0.10 = 800 \text{ SR/year}$

حامل التكاليف  $FAF = \frac{1.08^{20} - 1.10^{20}}{(0.08 - 0.10)} \times \frac{0.10}{(1.10^{20} - 1)} = \frac{4.66 - 6.73}{-0.02} \times \frac{0.10}{6.73 - 1} = 1.81$

التكاليف التشغيلية التآزرية  $EAC = 1.81 \times 800 = 1448 \text{ SR/year}$

(CHW=140)

$$H_{sp} = \frac{340}{9.81} = 34.65 \text{ m}$$

$$h_L = \frac{20}{100} H_{sp} = \frac{20}{100} \times 34.65 = 6.93 \text{ m}$$

$$6.93 = 1.1 H_f + \frac{1}{100} \times 198$$

$$\therefore H_f = \underline{4.5 \text{ m}}$$

$$N_{sp} = \left(\frac{198-6}{12}\right) + 1 = 17$$

$$F = 0.362$$

$$Q_L = 17 \times \frac{30}{60} = 8.5 \text{ L/s}$$

$$\therefore 4.5 = 1.22 \times 10^{10} \times 0.362 \times 198 \times \left(\frac{8.5}{140}\right)^{1.852} \times (D)^{-4.87}$$

$$D = 71.16 \text{ mm} = \underline{2.8 \text{ in}}$$

2.5 in & 3 in  $\rightarrow$   $\frac{2.5}{3}$   $\rightarrow$   $\frac{1.5}{1.5}$

$$d_1 = 3 \text{ in} = 76.2 \text{ mm}$$

$$d_2 = 2.5 \text{ in} = 63.5 \text{ mm}$$

$$L_1 = 102 \text{ m}$$

$$L_2 = 96 \text{ m}$$

$$N_{sp} = 9$$

$$N_{sp} = 8$$

$$F_2 = 0.377$$

$$Q_L = 4.5 \text{ L/s}$$

$$Q_L = 4.0 \text{ L/s}$$

$$H_{fL_2 \text{ for } d_2} = 1.22 \times 10^{10} \times 0.377 \times 96 \times \left(\frac{4}{140}\right)^{1.852} \times (63.5)^{-4.87} = 1.01 \text{ m}$$

$$H_{fL_2 \text{ for } d_1} = 1.22 \times 10^{10} \times 0.377 \times 96 \times \left(\frac{4}{140}\right)^{1.852} \times (76.2)^{-4.87} = 0.42 \text{ m}$$

$$H_f \text{ for all } d_1 = 1.22 \times 10^{10} \times 0.362 \times 198 \times \left(\frac{8.5}{140}\right)^{1.852} \times (76.2)^{-4.87} = 3.34 \text{ m}$$

$$H_f = 3.34 + 1.01 - 0.42 = 3.93$$

وهذا هو المطلوب  $\rightarrow$   $\frac{4.5 \text{ m}}{3.93} = 1.14$   $\rightarrow$   $\frac{1.14}{1.14} = 1$

$$d = \underline{3 \text{ in}} = 76.2 \text{ mm}$$

$$d_2 = \underline{2.5 \text{ in}} = 63.5 \text{ mm}$$

$$L_1 = \underline{78 \text{ m}}$$

$$L_2 = 120 \text{ m}$$

$$N_{sp} = 7$$

$$N_{sp} = 10$$

$$F_2 = 0.371$$

$$Q_L = 3.5 \text{ L/s}$$

$$Q_L = 5 \text{ L/s}$$

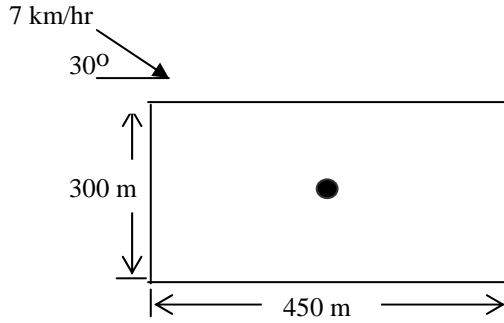
$$H_{fL_2 \text{ for } d_2} = 1.22 \times 10^{10} \times 0.371 \times 120 \times \left(\frac{5}{140}\right)^{1.852} \times (63.5)^{-4.87} = 1.88 \text{ m}$$

$$H_{fL_2 \text{ for } d_1} = 1.22 \times 10^{10} \times 0.371 \times 120 \times \left(\frac{5}{140}\right)^{1.852} \times (76.2)^{-4.87} = 0.78 \text{ m}$$

$$H_f \text{ for all } d_1 = \text{const} = 3.34 \text{ m}$$

$$\therefore H_f = 3.34 + 1.88 - 0.78 = 4.44 \text{ m} < 4.5 \text{ m}$$

وهذا هو المطلوب  $\rightarrow$   $\frac{4.5 \text{ m}}{4.44} = 1.01$   $\rightarrow$   $\frac{1.01}{1.01} = 1$



(150)

$S_{sm}$	9	12	18
$N_{sp}$	16.66	12.5	8.33
Lir	148.5	150	144

$\therefore S_s = 12m$   
 $N_{sp} = 12$

(450)

$S_{Lm}$	12	15	18
$N_L$	375	30	25
Lir	444	450	450

$S_L = 15m$   
 $N_L = 30 \times 2$

من جدول المواصفات الخاصة بالرياح، نجد أن سرعة الرياح هي 7 كم/س بزاوية 30° مع الأفق.

$d_{noz} = 4.76 \times 2.38 \text{ mm}$

$P_{sp} = 2.81 \text{ Kg/cm}^2$

$Q_{sp} = 1.88 \text{ m}^3/\text{hr}$

$T_{aw} = 80 \text{ mm/m}$

$D_{rx} = \frac{60 + 90}{2} = 75 \text{ cm}$

$T_{aw} = 80 \times 0.75 = 60 \text{ mm}$

$D_n = \frac{50}{100} \times 60 = 30 \text{ mm}$

$ET_c = 8.1 \text{ mm/day}$

$\therefore II = \frac{30}{8.1} = 3.7 = 4 \text{ day}$

$\therefore D_g = \frac{32.4}{0.65} = 49.85 \text{ mm}$

$T_i = \frac{D_g}{Ra} = \frac{49.85}{10.4} = 4.79 \text{ hr}$

$\therefore N_{total} = 2 \times 4 = 8$

$Q_{pump} = (8 \times 12 \times 1.88) + \left(\frac{8}{2} \times 1.88\right) = 180.48 + 7.52 = 188 \text{ m}^3/\text{hr} = 52.2 \text{ L/s}$

$Ra = \frac{Q_{sp}}{S_s \cdot S_L} = \frac{1.88}{12 \times 15} \times 1000 = 10.4 \text{ mm/hr}$

من جدول المواصفات الخاصة بالرياح، نجد أن سرعة الرياح هي 7 كم/س بزاوية 30° مع الأفق.

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$\therefore (D_n)_{act} = 4 \times 8.1 = 32.4 \text{ mm}$

$T_{day} = 1 \text{ hr} \quad \rho = E_a = 65\%$

$N/\text{day} = \frac{10}{4.79} = 2.1 = 2$

$\therefore (N_L)_{irr} = \frac{N_{L_{total}}}{N_{total}} = \frac{30 \times 2}{8} = 7.5 = 8 \text{ L/m}^2$

$$R_L = 5 \times 48 = 240 \text{ m}$$

$$Q_s = 180 \text{ m}^3/\text{hr} = 50 \text{ L/s}$$

$$R = 240 + 5 = 245 \text{ m}$$

$$A_i = \pi R^2 = \pi (245)^2 = 188574 \text{ m}^2$$

at  $x = 40\%$

$$\therefore Q_s = \frac{D_g \cdot A_i}{T_i} \quad \therefore D_g = \frac{180 \times 50}{188575} \times 1000 = 47.7 \text{ mm}$$

$$R_a = \frac{7200 \cdot Q_s}{R^2 \cdot D_w} = \frac{7200 \times 50}{245^2 \times 10} = 146.9 \text{ mm/hr}$$

$$V = \frac{2\pi R_L}{T_i} = \frac{2\pi \times 240}{50} = 30.16 \text{ m/hr}$$

at  $x = 100\%$

$$T_{rev} = T_{rev1} \times \frac{x_1}{x_2} = 50 \times \frac{40}{100} = 20 \text{ hr}$$

$$D_g = D_{g1} \times \frac{x_1}{x_2} = 47.7 \times \frac{40}{100} = 19.1 \text{ mm}$$

$$V = V_1 \times \frac{x_2}{x_1} = 30.16 \times \frac{100}{40} = 75.4 \text{ m/hr}$$

$$R_a = \text{const} = 146.9 \text{ mm/hr}$$

$$R_{am} = \frac{4}{\pi} \times 146.9 = 187 \text{ mm/hr}$$

$$h_{max} = \frac{3 Q_{sp} T_i}{\pi r_a^2} = \frac{3 \times 1.77 \times 2 \times 1000}{\pi (15)^2} = 15 \text{ mm}$$

$$h_A = \frac{h_{max}}{r_a} (N_{sp} r_a - r_{A1} - r_{A2} - r_{A3} - r_{AG}) = \frac{15}{15} (4 \times 15 - 0 - 12 - 12 - 12) = 24 \text{ mm}$$

$$h_B = h_C = h_D = h_A = 24 \text{ mm}$$

$$h_F = h_H = \frac{15}{15} (6 \times 15 - r_{F2} - r_{F3} - r_{F4} - r_{F8} - r_{F7} - r_{F6})$$

$$= 1 (90 - (4 \times 13.41) - (2 \times 6)) = 24.33 \text{ mm}$$

$$h_E = h_G = \frac{15}{15} (4 \times 15 - r_{E2} - r_{E3} - r_{E7} - r_{E6})$$

$$= 1 (60 - 6 - 6 - 13.47 - 13.41) = 21.16 \text{ mm}$$

$$h_K = \frac{15}{15} (4 \times 15 - r_3 - r_3 - r_6 - r_7) = 1 (60 - 4(8.485)) = 26 \text{ mm}$$

	$x_i$	$ x_i - \bar{x} $	$(x_i)_{\text{sort}}$
A	24	0.33	21.16
B	24	0.33	21.16
C	24	0.33	24
D	24	0.33	24
E	21.16	2.5	24
F	24.33	0.66	24.33
G	21.16	2.5	24.33
H	24.33	0.66	26
K	26	2.4	
$\Sigma$	213	10	

$$\bar{x} = \frac{213}{9} = 23.67 \text{ mm}$$

$$d = \frac{21.16 + 21.16}{2} = 21.16 \text{ mm}$$

$$C_u = \left(1 - \frac{10}{9 \times 23.67}\right) \times 100 = 95\%$$

$$D_u = \frac{21.16}{23.67} \times 100 = 89.4\%$$

$$R_a = \frac{1.77}{12 \times 12} \times 1000 = 12.29 \text{ mm/hh}$$

$$D_g = 12.29 \times 2 = 24.58 \text{ mm}$$

$$E_a = \frac{23.67}{24.58} \times 100 = 96.3\%$$