DSW

Ch-5 pump

$P = \frac{HQ}{3960}$

$P = \frac{QP}{1715}$

$P_1 = \frac{P}{E}$

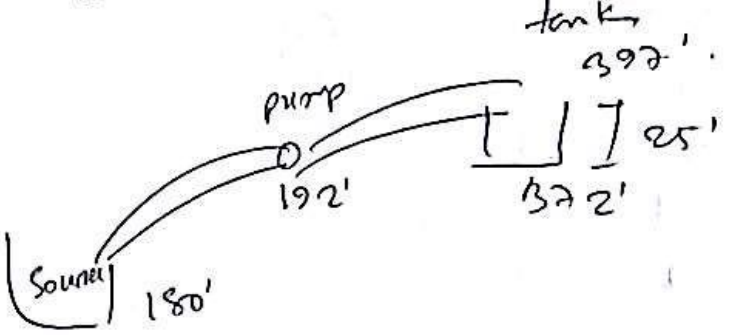
H = total lift

Q = volm. of water to be pumped gpm

E = efficiency of pump.

Problem-1 (P-207)

Q = 6750 gpm.



elevation of water surface in tank = 372 + 25
= 397'

Discharge lift = 397 - 192 = 205'

Suction lift = 192 - 180 = 12.

Total head H = 205 + 12 + 1.5*1.5 = 220 ft.
↳ minor head.

$P = \frac{HQ}{3960} = \frac{220 \times 6750}{3960} = 375$ (WHP)
↳ water Horse Power.

$P_1 = \frac{P}{E} = \frac{375}{0.67} = 560$ (BHP)
↳ Break horse power.

Problem-2

$Q = 450\,000$ gph.

$= \frac{450000}{60} = 7500$ gpm.

$Q = \frac{7500}{6.24} = \frac{1202}{60} = 20$ cfs.
(UK conversion)

Static head = 60'
Total length = 800'
$V = 12$ fps.
$f = 0.0075$
$E = 70\%$.

$Q = AV = \frac{\pi}{4} D^2 V$

$\Rightarrow \quad 20 = \frac{\pi}{4} \times D^2 \times 12 \Rightarrow D = 1.5$ ft

Total head loss $H = 60 + \frac{V^2}{2g} + 4f \cdot \frac{L}{D} \cdot \frac{V^2}{2g}$

$= 60 + \frac{12^2}{2 \times 32} + 0.0075 \times 4 \times \frac{12^2}{2 \times 32}$

$= 98.25$ ft

$P = \frac{HQ}{3960} = \frac{96.25 \times 7500}{3960} = 186$ (WHP)

$P_1 = \frac{P}{E} = \frac{186}{0.7} = 266$ (BHP)

Problem-3

$$Q = 425 \text{ mgd} = \frac{425 \times 10^6}{6.24 \times 24 \times 60 \times 60}$$

(UK, day, min, sec.)

$$= 788 \text{ cfs}$$

$$h_f = 300 \text{ ft.}$$

$$= 4 \times 0.0075 \times \frac{30 \times 1.61 \times 10^3 \times 3.28}{D} \times \frac{v^2}{2g} \quad \text{——— (1)}$$

We know, $Q = \frac{\pi}{4} D^2 v$

$$\Rightarrow 788 = \frac{\pi}{4} \times D^2 \times v. \Rightarrow V^2 = \frac{1.007 \times 10^6}{D^4}$$

$v^2 \rightarrow (1)$

$$300 = 4 \times 0.0075 \times \frac{30 \times 1.61 \times 10^3 \times 3.28}{D^5} \times \frac{1.007 \times 10^6}{D^4}$$

$$\Rightarrow D = 12'$$

Problem-4

$$Q = 5 \text{ mgd} = \frac{5 \times 10^6}{24 \times 60} = 3472 \text{ gpm.}$$

$$= \frac{3472}{6.24 \times 60} = 9.274 \text{ cfs}$$

Static head = 60'

$L = 120 + 400 = 520'$

pumping hours = 16 hr/day.

$$\therefore Q = \frac{5 \times 10^6}{16 \times 60} = 5208 \text{ gpm} = 13.9 \text{ cfs.}$$

$$Q = AV = \frac{\pi}{4} D^2 \cdot V$$

$$\Rightarrow 13.9 = \frac{\pi}{4} \times D^2 \times 6$$

$$\Rightarrow D = 1.72' \approx 1.75'$$

for @ $D = 1.75'$

$$13.9 = \frac{\pi}{4} \times 1.75^2 \times V$$

$$\Rightarrow V = 5.78 \text{ fps.}$$

$$\text{total head} = 60 + \frac{5.78^2}{2 \times 32.2} + 4 \times 0.0075 \times \frac{520}{1.75} \times \frac{5.78^2}{2 \times 32.2}$$

$$= 65.14 \text{ ft}$$

$$P = \frac{QH}{3960} = \frac{65.14 \times 5208}{3960} = 86 \text{ (WHP)}$$

$$P_1 = \frac{P}{E} = \frac{86}{0.75} = 115 \text{ (BHP)}$$

problem-5 $Q = 40$ sped. $= \frac{40 \times 85000}{10 \times 60}$

$= 5666.67$ spm

$= \frac{5666.67}{6.24 \times 80}$

$= 15.14$ cfs.

$Q = AV$

$\Rightarrow 15.14 = \frac{\pi}{4} D^2 \times 8.$ $V = 8$ fps

$\Rightarrow D = 1.55' \approx 1.75'$

for 1.75'

$$15.14 = \frac{\pi}{4} \times 1.75^2 \times V$$

$$\Rightarrow D = 6.29 \text{ fps}$$

Total head loss = ~~60~~ $\cdot (193 - 192.5) +$

$$\frac{6.29^2}{2 \times 32.2} + 4 \times 0.01 \times \frac{3500}{1.75} \times \frac{6.29^2}{2 \times 32.2}$$

$$= 140.26 \text{ ft}.$$

$$P = \frac{140.26 \times 5666.67}{3960} = 201 \text{ WHP}.$$

$$P_1 = \frac{201}{0.65} = 309 \text{ BHP}$$

Ques

14-15 → 7 (c)

13-14 →

12-13 → 1 (b)
3 (c)

11-12 → 2 (b)

10-11 →

9-10 → 6 (c)

8 → → 7 (c)

7-8 → 7 (b)

7-10 6©

$$Q = \frac{45 \times 90000 \times 3.78 \times 10^{-3}}{12 \times 60 \times 60} = 0.355\ m^3/s.$$

$$Q = 0.355 = \frac{\pi}{4} D^2 V = \frac{\pi}{4} D^2 \times 2.5$$

$$\Rightarrow D = 0.425m \approx 0.5m$$

for $D = 0.5m$.

$$Q = 0.355 = \frac{\pi}{4} \times 0.5^2 \times V$$

$$\Rightarrow V = 1.8\ m/s$$

$$H = (58.5 + 30) + 4 \times 0.011 \times \frac{1100}{0.5} \times \frac{1.8^2}{2 \times 9.81}$$

$$= 44.5m.$$

$$P_2 \quad \frac{QWH}{75} = \frac{0.355 \times 1000 \times 44.5}{75}$$

$$= 211 \text{ ~~kWH~~} \cdot \text{WHP}.$$

$$P' = \frac{211}{0.9 \times 0.75} = 313\ HP.$$

2008-9

$Q = 40\,00\,000$ lpd.

$= \frac{40\,00\,000 \times 10^{-3}\ m^3}{6 \times 3600 \times 2} = 0.0925\ m^3/s$

Suction head = $25 - 30 = -5$ m.

delivery " = $70 - 25 = 45$ m.

Total elevation head = $-5 + 45 = 40$ m

$Q = AV$

$\Rightarrow 0.0925 = \frac{\pi}{4} D^2 \times 1.8$

$\Rightarrow D = 0.81$ m.

$H = 40 + \frac{4 \times 0.009 \times \frac{1200}{0.81} \times \frac{1.8^2}{2 \times 9.81}}{\hookrightarrow \left[4f \cdot \frac{L}{D} \cdot \frac{v^2}{2g} \right]} = 48.97$ m.

$P = \frac{QWH}{75} = \frac{0.925 \times 1000 \times 48.97}{75} = 604$ WHP.

$P' = \frac{604}{0.68} = 888$ BHP.

14-15 7 © Rain example - 4

13-14

12-13 1 (a) (?)
3 (d) ?

11-12

2 (b)

$$Q = \frac{100 \times 40000 \times 10^{-3} \times 1.5}{16 \times 60 \times 60}$$

$$= 0.1042 \ m^3/s.$$

$L = 1$ Km.

level difference = 20m.

$E = 70\%$
$f = 0.01$
$V = 2 m/s.$

$Q = AV$

$\Rightarrow 0.1042 = \frac{\pi}{4} \times D^2 \times 2$

$\Rightarrow D = 0.257 m. \simeq 0.3 m.$

for 0.3m pipe

$$0.1042 = \frac{\pi}{4} \times 0.3^2 \times V.$$

$$\Rightarrow V = 1.47 \ m/s$$

$$H = 20 + 4f \cdot \frac{L}{D} \frac{v^2}{2g}$$

$$= 20 + 4 \times 0.01 * \frac{1000}{0.3} \times \frac{1.47^2}{2 \times 9.8}$$

$$= 34.7 \text{ m.}$$

$$P = \frac{QwH}{75} = \frac{0.1042 \times 1000 \times 34.7}{75}$$

$$= 48.2 \text{ WHP.}$$

$$P' = \frac{P}{E} = \frac{48.2}{0.7} = 68.67 \text{ BHP}$$

(?) eto kom ken.
might be did some mistake

Economical tank design:

→ see example Aziz - Page 400

13-14 & ⓒ

11-12 & ⓓ

9-10 · 1 ⓓ

8-9 3 Ⓐ

7-10

1 ⓓ

$$V = \left(\pi r^2 + 2\pi rh\right) \cdot \frac{1}{4}$$

$$V = \pi r^2 h.$$

$$C = \pi r^2 \times 300 + 2\pi rh \times 400.$$

$$\Rightarrow C = 300\pi r^2 + 800\pi r \cdot \frac{V}{\pi r^2}$$

$$\Rightarrow C = 300\pi r^2 + 800\frac{V}{r}$$

$$\Rightarrow \frac{dc}{dr} = 600\pi r - \frac{800V}{r^2} = 0.$$

$$\Rightarrow r^3 = \frac{800V}{600\pi}$$

$V = 2\times10^5$ gallons $= 7.57\times10^5$ liters.

1 gal = 3.78 lit
1 L = 0.04 ft³

$$= 7.57\times10^5 \times 10^{-3} \times 3.28^3$$

$$= 26.7\times10^3 \text{ ft}^3$$

$$v = \frac{2\times10^5}{7.48}\ ft^3 = 26.7\times10^3\ ft^3$$

$$\therefore\ r^3 = \frac{800\times26.7\times10^3}{600\pi}$$

$$= 22.5'$$

$$V = 26.7\times10^3 = \pi r^2 h$$

$$\Rightarrow h = 16.8'$$

<u>86-9</u>

3(v)

from 3(iv) math.

$$V = 40\,gped. = \frac{40\times2.09\times10^5}{24}\times6.$$

$$= 2.09\times10^6\ gallon.$$

$$= \frac{2.09\times10^6}{7.48} = 2.79\times10^5\ ft^3.$$

rest same.

$r = 48.1'$ $h = 38.4'$

5 days off

So, no problem.

[illegible]