Head

Total Dynamic Head

Total equivalent height of water column needed to pump

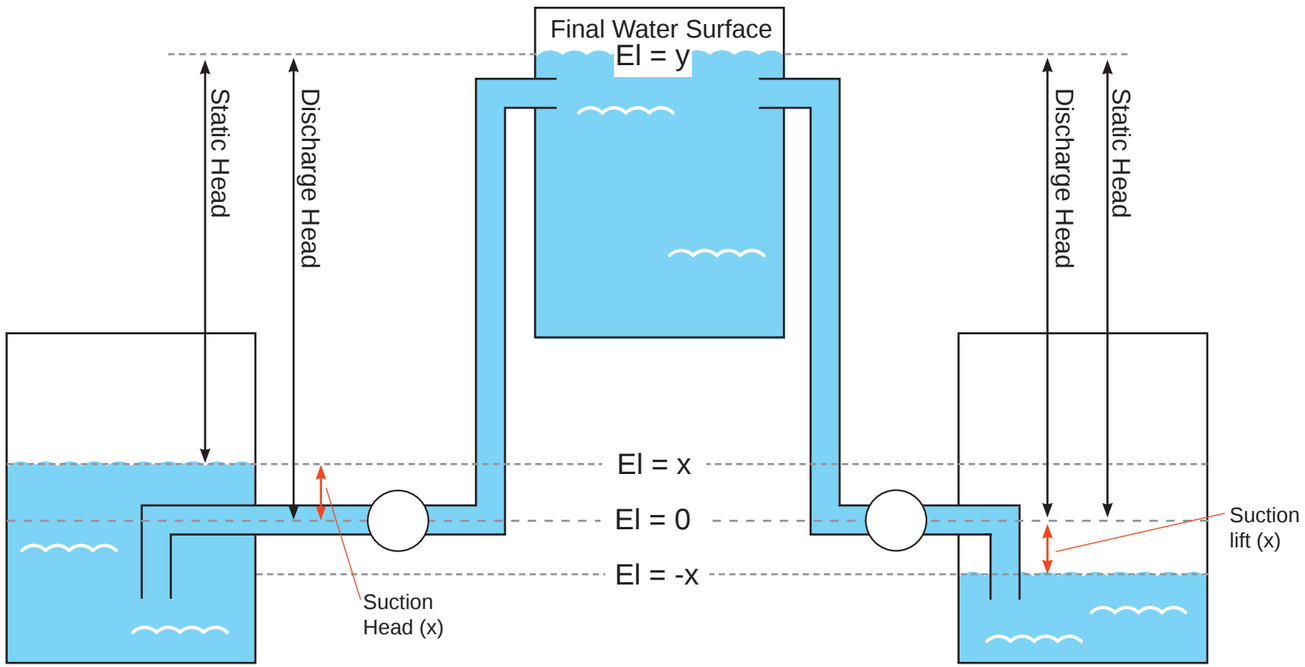
Friction Head

Head associated with energy losses due energy losses due to friction

Static Head

Head associated with the height the water has to be raised

Calculating Static Head

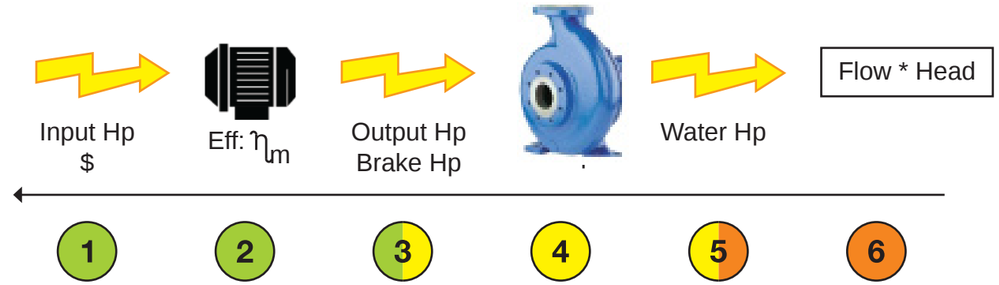


Case A:
Initial water level above pump

Static Head = y-x

Case B:
Initial water level below pump

Static Head = y-(-x)
= y+x



Given 6 **Calculate** 5

What is the required water horsepower to pump 300 GPM if the suction head and discharge heads are constant at 20 ft and 120 ft respectively and the system head losses are 5 ft.

Solution:

$$\frac{300\ \text{GPM} \times (120-20+5\ \text{ft})}{3960\left(\frac{\text{GPM-ft}}{\text{Hp}}\right)} = \boxed{7.95\text{Hp}}$$

Given 2 4 5 **Calculate** 1

Find the input Hp Given the water Hp equals 8Hp and the pump and motor efficiencies are 80% and 50% respectively.

Solution:

Step 1: Find 3 knowing 4 & 5

$$0.5 = \frac{8\text{Hp}}{\text{Brake Hp}} = \text{Brake Hp} = 16\text{Hp}$$

Step 2: Find 1 knowing 2 & 3

$$0.8 = \frac{\text{Brake Hp}}{\text{Input Hp}} = \frac{16}{\text{Input Hp}}$$

$$\text{Input Hp} = \frac{16}{0.8} = \boxed{20\text{Hp}}$$

Given 3 **and existing** 2 **& replacement** 2 **Calculate** 1 **savings**

An older motor which is 82% efficient is to be replaced by a new, 94% efficient motor. Calculate the annual savings for the new motor given the output horsepower from both motors is 180Hp and the electricity cost is $0.075/kWh & the motor operates 24 hours per day throughout the year.

$$\text{Hp input to } \textit{new} \text{ motor} = \frac{180}{0.94} = 191.5\text{Hp} \qquad \text{Hp input to } \textit{old} \text{ motor} = \frac{180}{0.82} = 218.5\text{Hp}$$

Annual Savings $\rightarrow (218.5-191.5)\text{Hp} \times \frac{0.746\ \text{Kw}}{\text{Hp}} \times \frac{365 \times 24\ \text{hrs}}{\text{Year}} \times \frac{\$0.075}{\text{Kwh}} = \boxed{\frac{\$23{,}779}{\text{Year}}}$

"Demand Charge" ($/kw) is imposed on consumer by the utility company to compensate it for the design & upkeep of equipment to meet the peak power draw by the consumer. The demand charge is in addition to the regular energy consumption charge ($/kw). The demand charge is based upon highest power consumption over any 15 minute period during the billing cycle. Oversized and inefficient equipment (motors & pumps) would mean higher demand charges.