

13.17 For a given centrifugal pump, if the speed of rotation of the impeller is cut in half, how does the total head capability change?

Given: Impeller N_1 initial speed
new speed is impeller $N_2 = N_1/2$

solution Second law for head!

$$\frac{H_1}{H_2} = \left(\frac{N_1}{N_2} \right)^2 =$$

$$\Rightarrow \frac{H_1}{H_2} = \left(\frac{N_1}{(N_1/2)} \right)^2 = 2 \left(\frac{N_1}{N_1} \right)^2 = 2^2 = 4$$

$$H_2 = \frac{H_1}{4}$$

The impeller speed in a centrifugal pump is splitting into headnose nozzles, since a lot of water is coming out with a lot of force, which means that the head produced in the pump would be 25% of the original speed

Q. 13.19 For a given size of centrifugal pump, if the diameter of the impeller is reduced by 25 percent, how much does the capacity change?

Given: initial diameter is D_1
the new diameter impeller is $D_2 = 0.75 \times D_1$

Solution: first affinity law rate

$$\frac{Q_1}{Q_2} = \frac{D_1}{D_2}$$

$$\frac{Q_1}{Q_2} = \frac{D_1}{0.75 \times D_1} = \frac{1}{0.75} = \frac{4}{3}$$
$$Q_2 = Q_1 \times 0.75$$

When the nozzle of a hose is fully open you may get only a certain amount of water flow coming. Since the pump is reduced by 25% of the flow capacity. As you close it the flow will keep reducing 25% all the way to 75%.

13.22 Describe each part of this centrifugal pump. designation: $1\frac{1}{2} \times 3 - 6$

Given: $1\frac{1}{2}$ is the inlet diameter of the pump
3 is the outlet diameter
6 is impeller diameter.

Solution: Inlet Diameter ($1\frac{1}{2}$ in)

- the inlet diameter

- the dimension dictate how much fluid comes into the pump

Outlet Diameter (3 in)

- this part the fluid exit the pump

- this dimension allow less fluid from pump since it is bigger

Impeller Diameter (6 in)

- impeller is rotating part of the pump that transfers energy

- the diameter of the impeller is a huge factor

since it is the biggest part, this determines the pump's performance. such as calculations like flow rate and head

13.23 For the line of pumps shown in fig. 13.22 specify a suitable size for delivering 100 gal/min of water at a total head of 300 ft.

Given: Flow rate = 100 gal/min, total head 300 ft

Solution: Upon looking at the chart the lines that intersect each other are at the following location. Which is at 2x3-6 at 100 total head and 300 capacity.