

## Discharge Regulation of Centrifugal Pumps

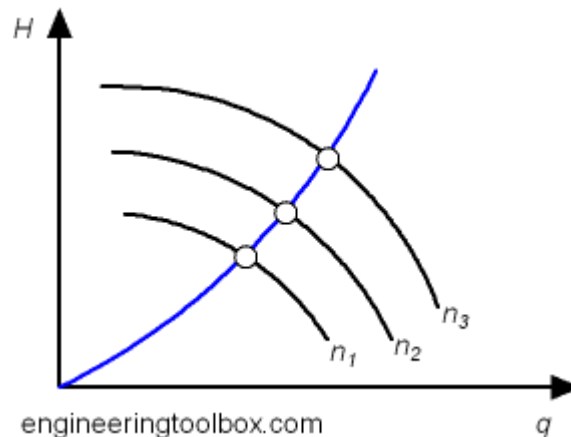
### Adapting pump capacities to process demand

It is often necessary to adapt the pump capacity to a temporary or permanent change in the process demand.

The capacity of a centrifugal pump can be regulated either at

- constant speed, or
- varying speed

### Capacity Regulating by Varying Speed



Speed regulating is energy efficient since the energy to the pump is reduced with the decrease of speed.

The speed of the pump can be varied with

- hydraulic/hydrostatic drives - hydraulic coupling between input and output shaft - speed ratio 5 to 1 is controlled by adjusting the volume of oil in the coupling
- mechanical drives - belt and sheave drive
- eddy current drive/clutch - magnetic coupling transfer load torque between input and output shaft
- variable speed drives - inverters - AC drives - adjustable frequency drives - operates by varying the frequency and voltage to the electric motor

The change in power consumption, head and volume rate can be estimated with the [affinity laws](#).

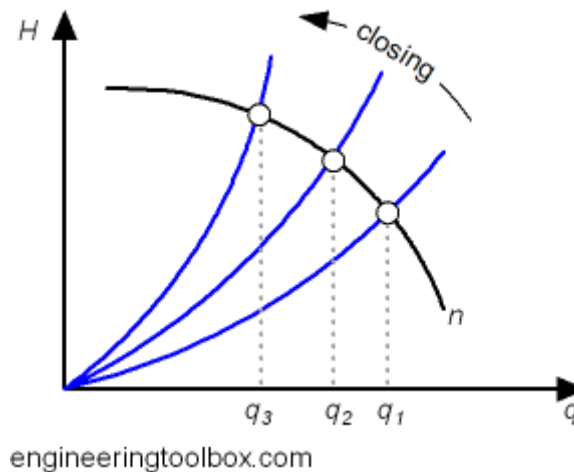
## Capacity Regulating by Constant Speed

Capacity can be regulated at constant speed by

- throttling
- bypassing flow
- changing impeller diameter
- modifying the impeller

### **Throttling**

Throttling can be carried out by opening and closing a discharge valve.



Throttling is energy inefficient since the energy to the pump is not reduced. Energy is wasted by increasing the dynamic loss.

### **Bypassing Flow**

The discharge capacity can be regulated by leading a part of the discharge flow back to the suction side of the pump. Bypassing the flow is energy inefficient since the energy to the pump is not reduced.

### **Changing the Impeller Diameter**

Reducing the impellers diameter is a permanent change and the method can be used where the change in process demand is temporary. The method may be energy efficient if the motor is changed and the energy consumption reduced.

The change in power consumption, head and volume rate can be estimated with the [affinity laws](#).

### **Modifying the Impeller**

The flow rate and the head can be modulated by changing the pitch of the blades. Complicated and seldom used.

## Pump Regulation and Power Consumption

Power consumption of some of the regulating methods are compared in the figure below:

