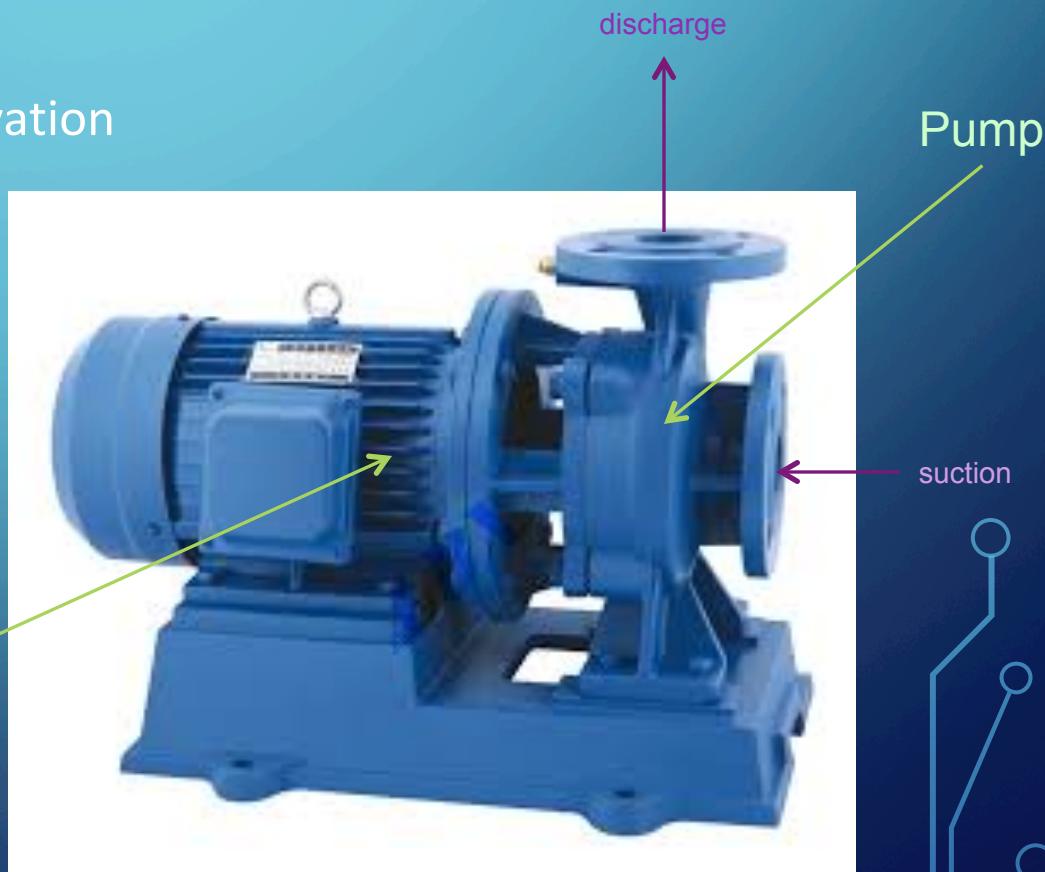


# CE 3372 WATER SYSTEMS DESIGN

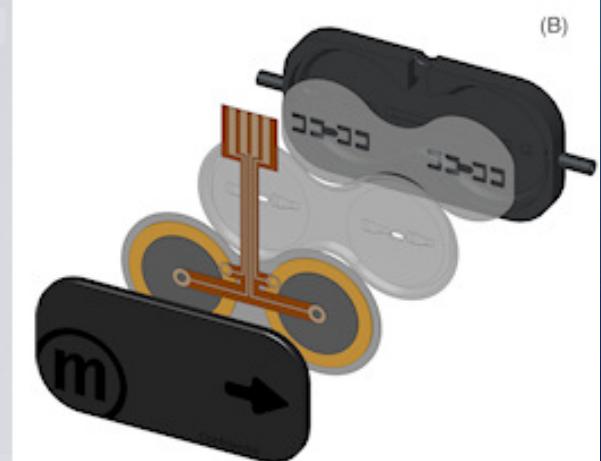
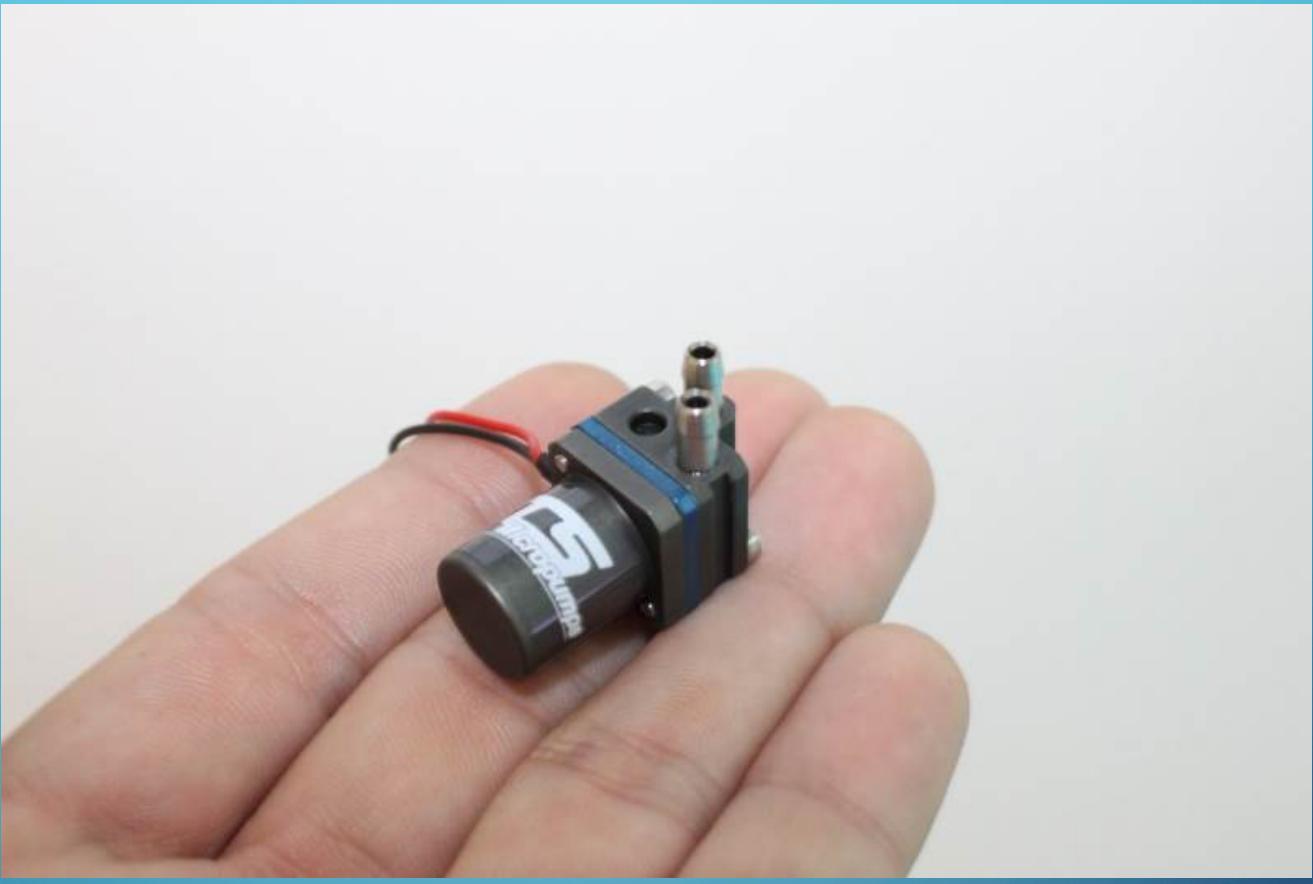
PUMPS AND LIFT STATIONS –PART 1 (FALL 2020)

# PUMPS

- A mechanical device that transfers mechanical energy into a liquid; used to
  - Lift from lower to higher elevation  
Lift stations
  - Increase pressure  
Booster stations
  - Gas phase equivalent
    - Compressor







# PUMPS

- Positive (Fixed) Displacement Pumps
  - Fixed volume of fluid is displaced each cycle regardless of system static head/pressure
  - Lower flow rates and higher head than non-positive pumps
- Variable Displacement Pumps
  - Varying volume of fluid is displaced dependent on system static head/pressure (back pressure)

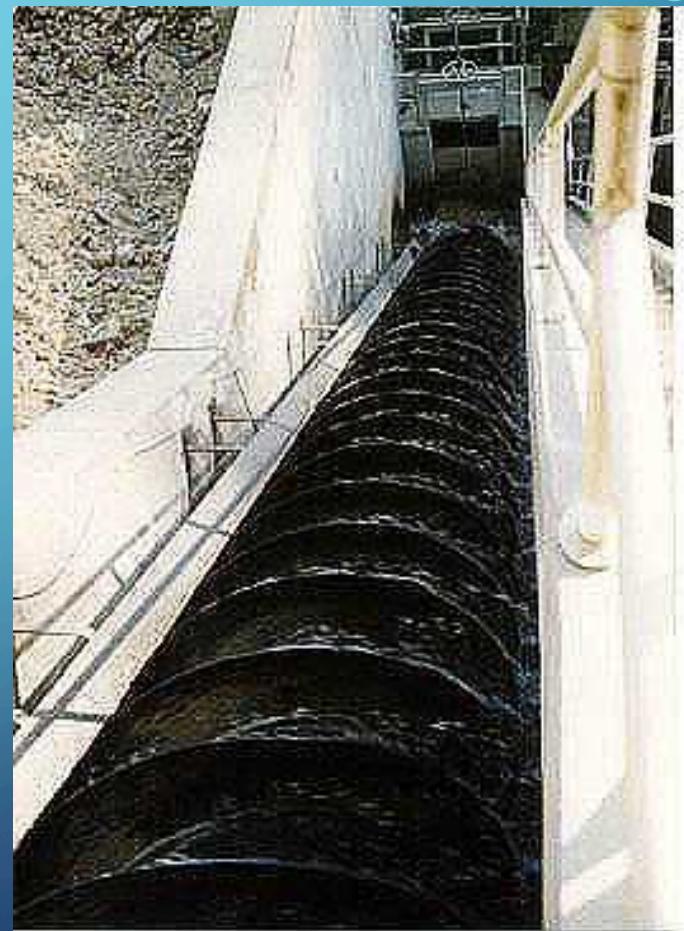
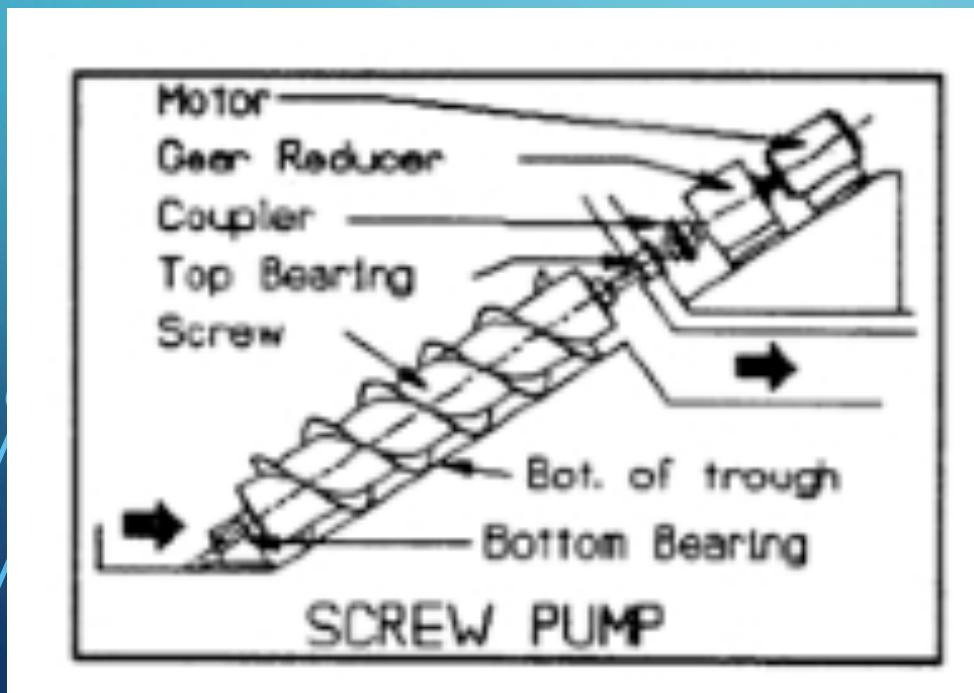
# PUMPS

- Fixed Displacement Pumps
  - Screw Pumps
  - Reciprocating Pumps
- Variable Displacement Pumps
  - Centrifugal (Radial-Flow) Pumps
  - Propeller Pumps (Axial-Flow)
  - Jet Pumps (Mixed-Flow)

# POSITIVE DISPLACEMENT PUMPS

## Screw Pump

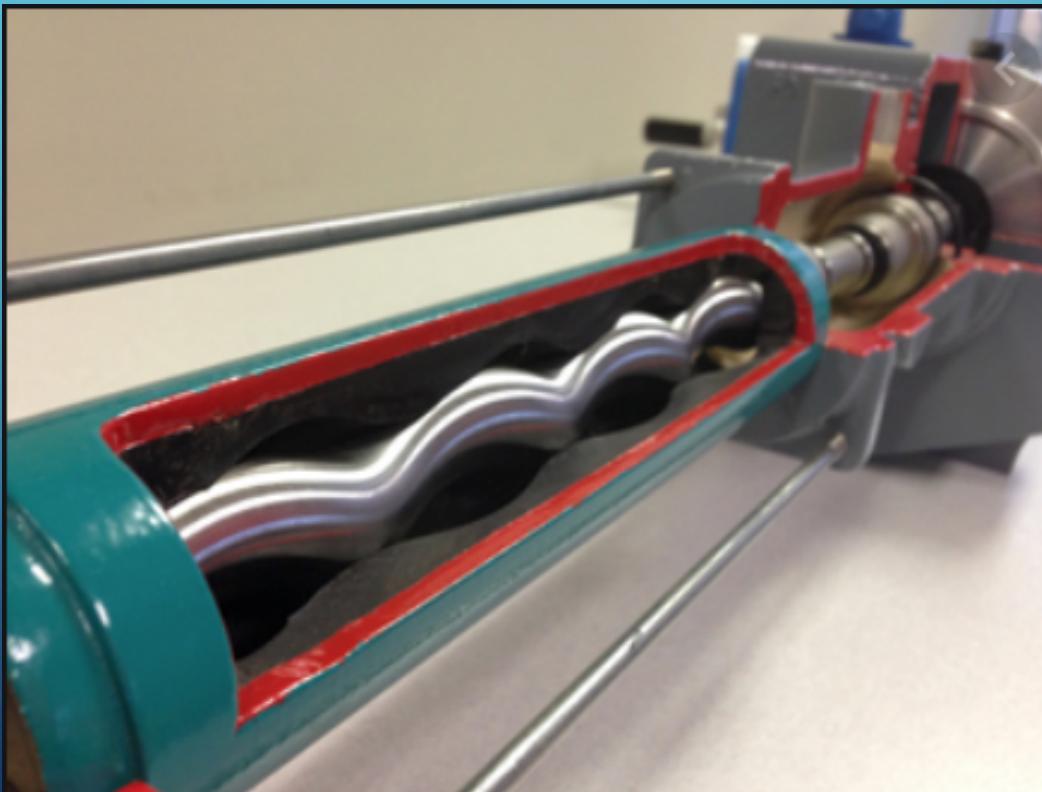
- A revolving shaft with blades rotates in a trough at an incline and pushes water up



# POSITIVE DISPLACEMENT PUMPS

- Progressive Cavity Pump

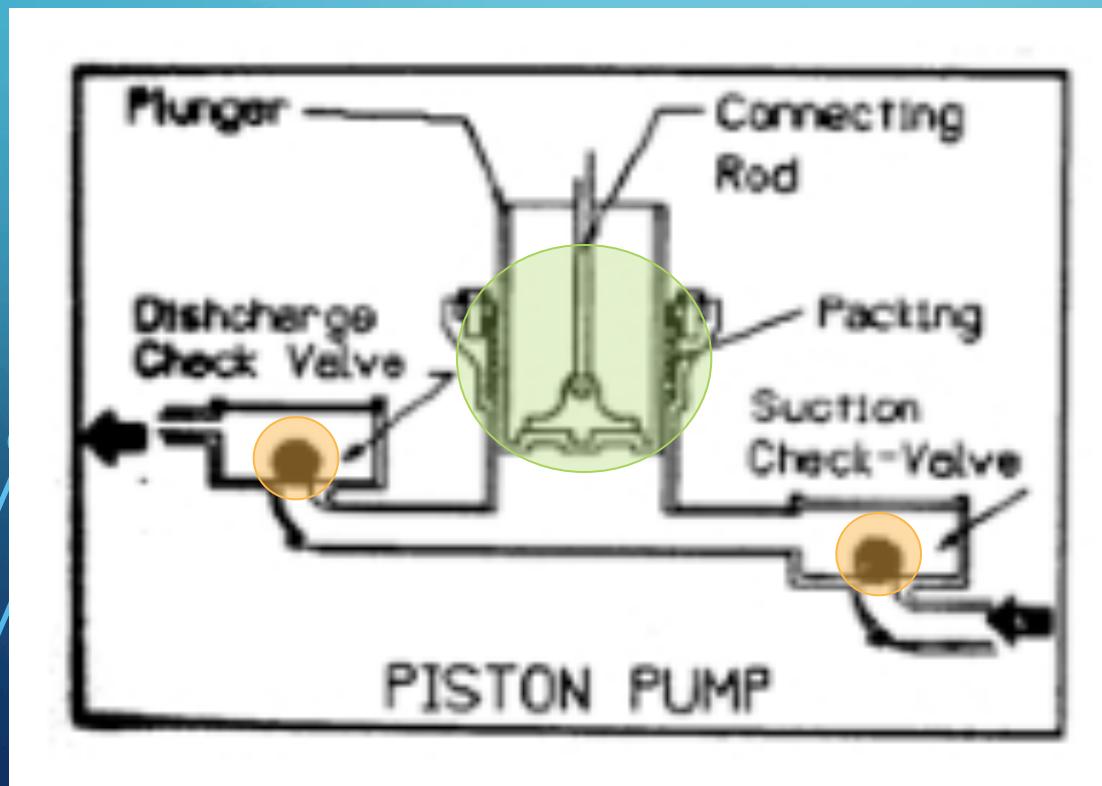
- A revolving shaft (rotor) with lobes rotates in a trough (stator)



# POSITIVE DISPLACEMENT PUMPS

- Reciprocating Piston Pump

- A piston sucks the fluid into a cylinder and then pushes it out

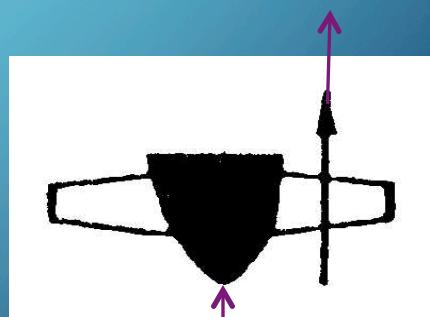


# PUMPS

- Fixed Displacement Pumps
  - Screw Pumps
  - Reciprocating Pumps
- Variable Displacement Pumps
  - Centrifugal (Radial-Flow) Pumps
  - Propeller Pumps (Axial-Flow)
  - Jet Pumps (Mixed-Flow)

# VARIABLE DISPLACEMENT PUMPS

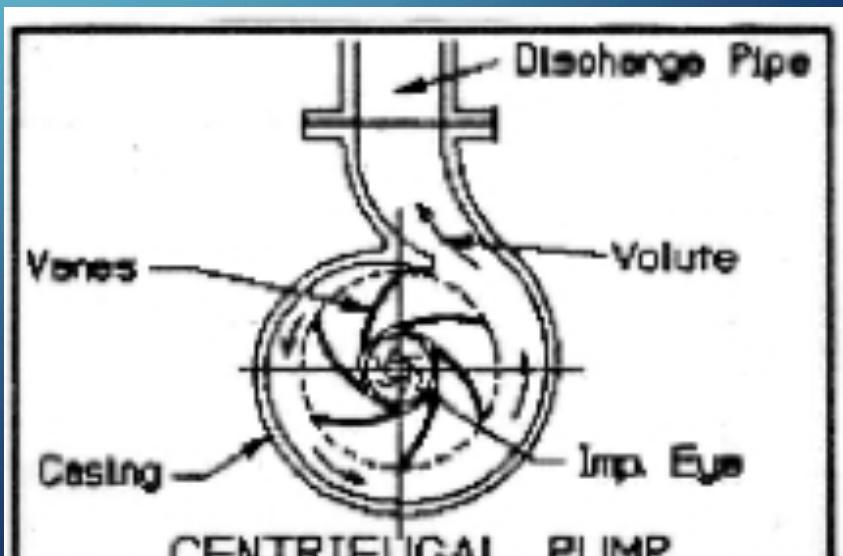
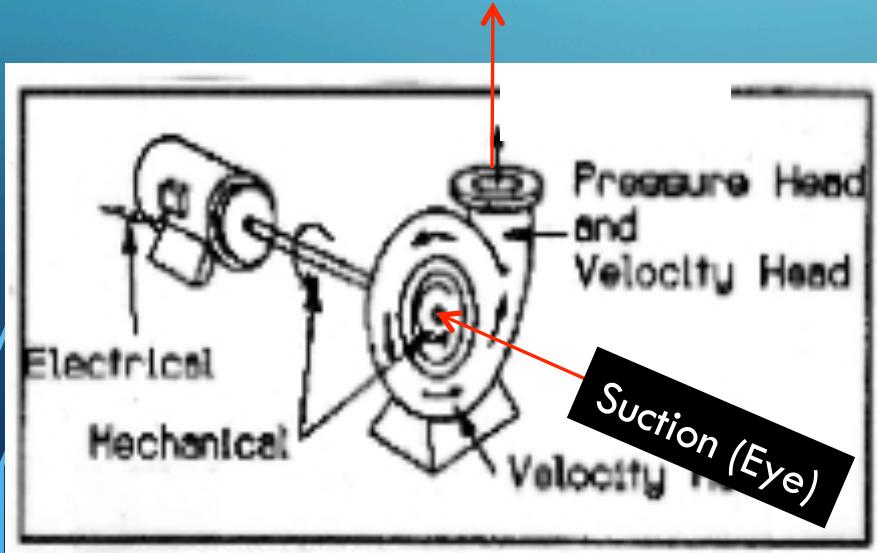
- Classification is based on the way water leaves the rotating part of the pump
  - Radial-flow pump – water leaves impeller in radial direction
  - Axial-flow pump – water leaves propeller in the axial direction
  - Mixed-flow pump – water leaves impeller in an inclined direction (has both radial and axial components)



# RADIAL-FLOW PUMPS

- Centrifugal Pump

- Accelerates water using an impeller
- <https://www.youtube.com/watch?v=BaEHVpKc-1Q>
- [https://www.youtube.com/watch?feature=player\\_detailpage&v=ECv1VwW6RTo#t=122](https://www.youtube.com/watch?feature=player_detailpage&v=ECv1VwW6RTo#t=122)



# AXIAL FLOW PUMPS

- Axial flow pumps have impellers whose axis of rotation is collinear with the discharge
- Used in high flow, low head applications

