

TECHNOLOGIES FOR PUMPING VARIOUS FLUIDS: SLUDGE, GRIT AND SCUM

OTCO-B12269-OM

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Pump Basics - Terminology

Flow

The action of moving fluid along in a steady, continuous stream

Total Dynamic Head (TDH)

The total equivalent height that a fluid is to be pumped. TDH takes into account friction losses in piping, as well as suction pressures. Typically used when referring to centrifugal pump performance.



Pump Basics - Terminology

Viscosity

A numeric value associated with fluids that corresponds to its resistance to flow.

Specific Gravity (S.G.)

The ratio of the density of a gallon of fluid, as compared to that of water. (*For example: S.G. of water at 70°F is 1; S.G. of 100% sulfuric acid at 68°F is 1.84*)



Pump Basics - Terminology

Temperature

Degree or intensity of heat present in a fluid

Net Positive Suction Head (NPSH)

The difference between suction pressure and the vapor pressure of a given fluid. ***NPSH_a*** is the pressure available at the suction port of a pump. ***NPSH_r*** is the minimum pressure required at the suction of the pump to keep the pump from cavitating.



Pump Technologies

A pump is a device that moves fluids, (which includes liquids and gases) or sometimes slurries, by mechanical action.

Pumps can be categorized into two basic types:

Centrifugal Pumps

Positive Displacement Pumps



Centrifugal Pumps

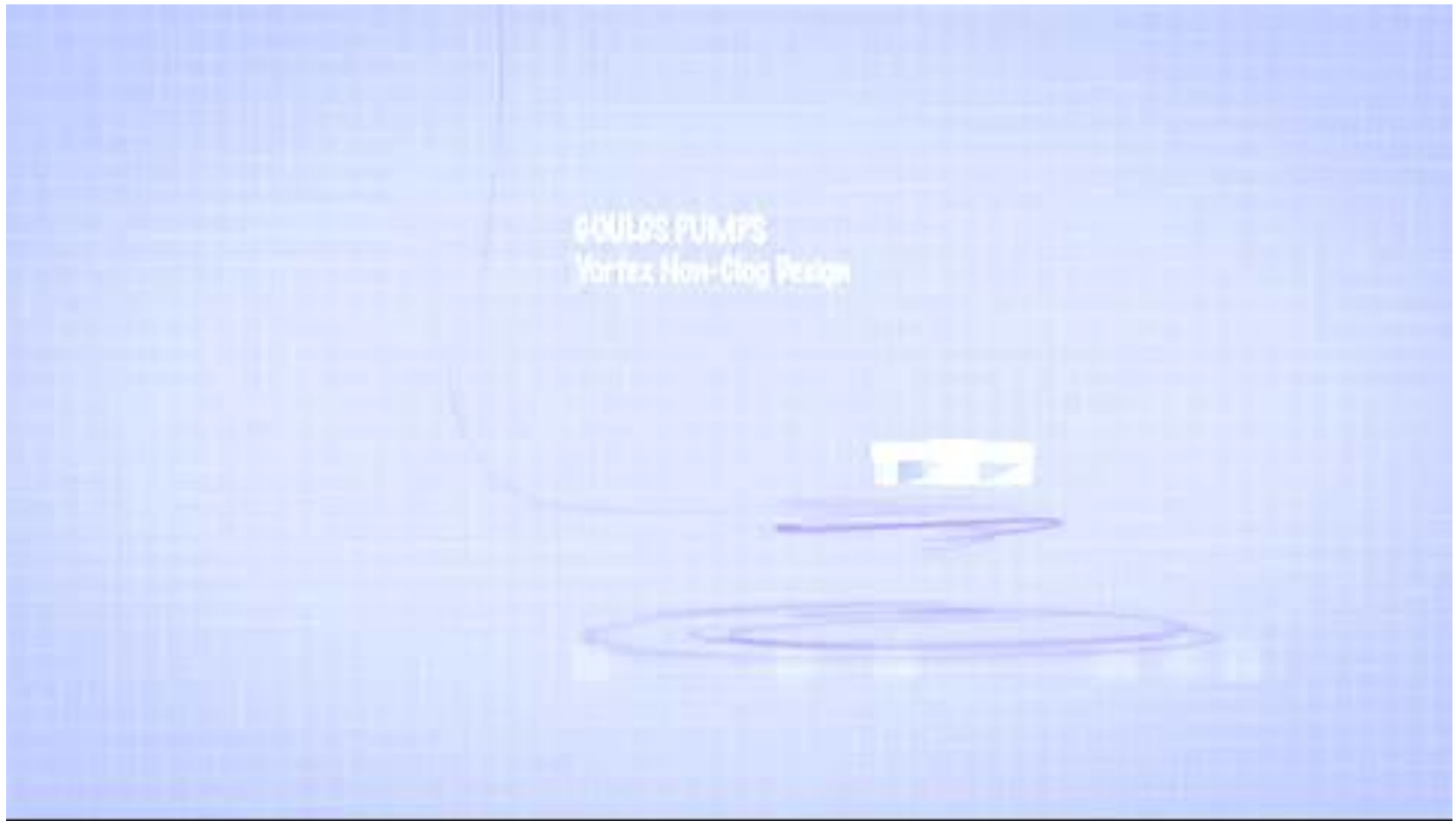
Fluid enters axially through eye of the casing and is caught in the impeller vanes. It is then whirled tangentially and radially outward until it leaves through all circumferential parts of the impeller into the diffuser part of the casing. The fluid gains both velocity and pressure while passing through the impeller. Types include:

Vortex Pumps

Screw Centrifugal Pumps



Vortex Pumps



Vortex Pumps



Vortex Pump: Principle or Operation

- The impeller spins in an area of the volute that is completely out of the liquid flow path.
- The spinning creates a vortex within the pump casing.
- Since the impeller is not in the flow path of the volute, the pump is ideal for handling liquids that contain long stringy solids, large diameter solids, slurries or a combination of all of these without plugging up.



Vortex Pumps

Features and Benefits:

- Pumped product has very little contact with the impeller
- Allows the passage of larger solids and stringy materials without getting caught up in the impeller
- Ability to pump materials entrained with air
- Simple design
- Low capital cost



Vortex Pumps

Disadvantages:

- Fluid viscosity limitations
- Low efficiencies
- Limited turn down capacities



Vortex Pumps

Popular Brands:

Flygt

WEMCO

Egger

Goulds

Gusher



Screw Centrifugal Pumps

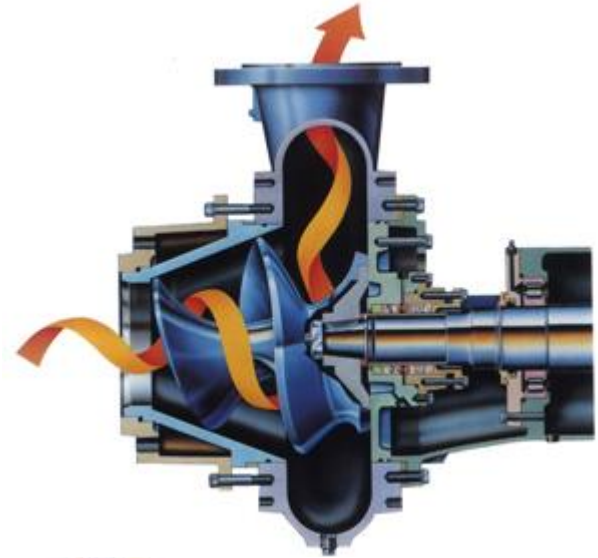
Popular Brands:

WEMCO-Hidrostal

Hayward Gordon

VerderHUS

Vaughn



Positive Displacement Pumps

A positive displacement pump makes a fluid move by trapping a fixed amount of it and forcing (displacing) that trapped volume into the discharge port. Types include:

Rotary Lobe Pumps

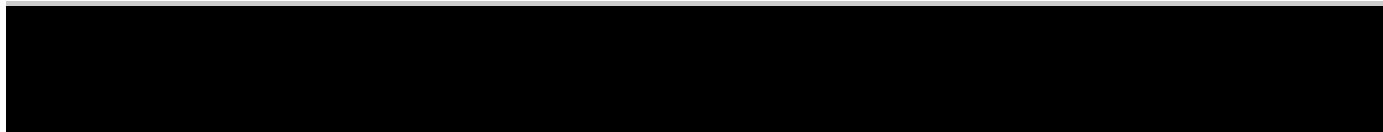
Progressive Cavity Pumps

Peristaltic Pumps

Disc Pumps



Rotary Lobe Pumps



Rotary Lobe Pump: Principle or Operation

- As the pumps lobes rotate, they come out of mesh, leaving an opening, referred to as a cavity.
- Fluid flows into the cavity, and traps the fluid as the lobes rotate.
- The fluid is moved around the outside of the pump casing – **NOT** through its centerline.
- As the lobes mesh again, the fluid is forced out of the discharge of the pump.



Rotary Lobe Pumps

Features and Benefits:

- Run-dry with double seal configuration
- Can be maintained in line
- Reversible operation
- Able to pass large solids
- Small overall footprint compared to progressive cavity pumps
- High volumetric efficiency



Rotary Lobe Pumps

Disadvantages:

- Minimum dry suction lift capabilities
- Fast running of the unit can increase the possibility of cavitation, causing premature wear of the lobes
- Two shafts require two sealing methods
- Requires timing gears
- Internal slip occurs when pumping thin fluids (generally less than 300 cPs)



Rotary Lobe Pumps

Popular Brands:

SSP by Alfa Laval

Boerger

Vogelsang

Netzsch

Lobeline



Progressive Cavity Pumps



Progressive Cavity Pumps: Principle or Operation

- A progressive cavity pump transfers fluid by means of the progress of a sequence of small, fixed shape cavities through the pump.
- As the rotor turns, fluid trapped in each cavity is transferred to the next cavity until it is eventually discharged.
- The rotor, moving in an “eccentric” motion, requires pin, cardan and/or gear joints to transfer the radial motion of the drive shaft to the eccentric motion of the rotor.



Progressive Cavity Pumps

Features and Benefits:

- Sealing takes place on the suction side of the pump
- Gentle handling and shear sensitive
- Suitable for pumping products with dry solids content up to 45%
- Capable of producing high discharge pressure



Progressive Cavity Pumps

Disadvantages:

- Cannot run dry
- Large footprint
- Maintenance is difficult, time consuming and costly to perform (up to 75% of the cost of a new pump)
- Requires a cardan, pin or joint shaft which is located in the typical suction path of the pump and become susceptible to “ragging”



Progressive Cavity Pumps

Popular Brands:

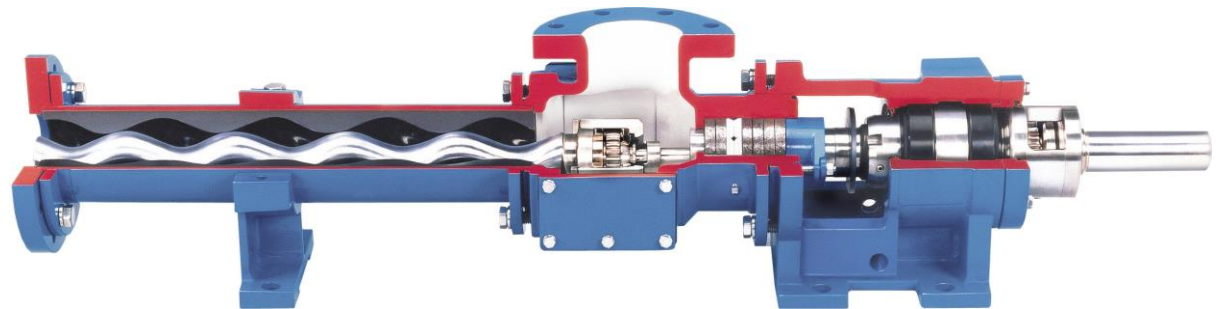
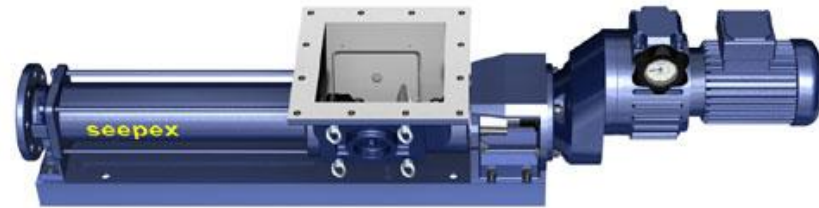
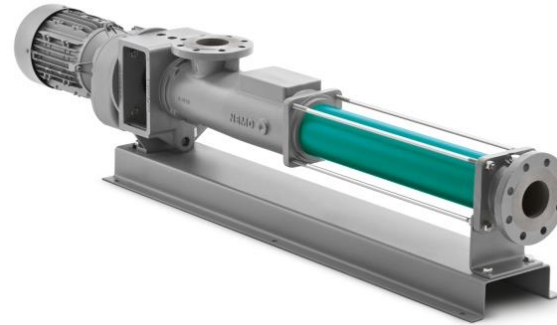
Seepex

Moyno

Netzsch

Flowrox

Mono



Peristaltic Hose Pumps

VERDERFLEX[®]



Peristaltic Hose Pumps: Principle or Operation

- The fluid is contained within a flexible hose fitted inside a circular pump casing.
- A rotor with a number of rollers, shoes or wipers (cams) compress the hose.
- As the rotor turns, the fluid is forced through the hose by the cams.
- As the cams leaves the hose, fluid is then introduced again from the suction side.



Peristaltic Hose Pumps

Features and Benefits:

- Pumped fluid has no contact with the pump, only with the hose
- Can run dry
- Hose life is not affected by abrasive fluids
- Lubricant and hose are the only “wear” parts
- Virtually no slip within the pump



Peristaltic Hose Pumps

Disadvantages:

- Larger footprint
- Typically lower flows (up to 395 GPM)
- Inner diameter of hose dictates solids handling capability
- Requires use of inlet stabilizers and pulsation dampeners to optimize the entire system



Peristaltic Hose Pumps

Popular Brands:

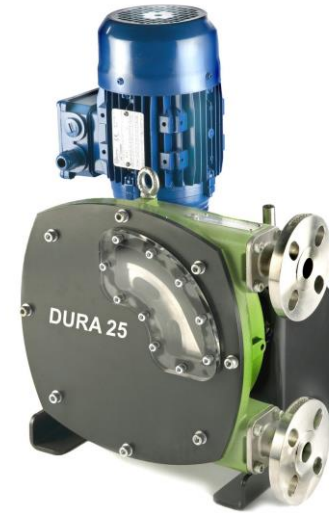
Verder

Watson-Marlow

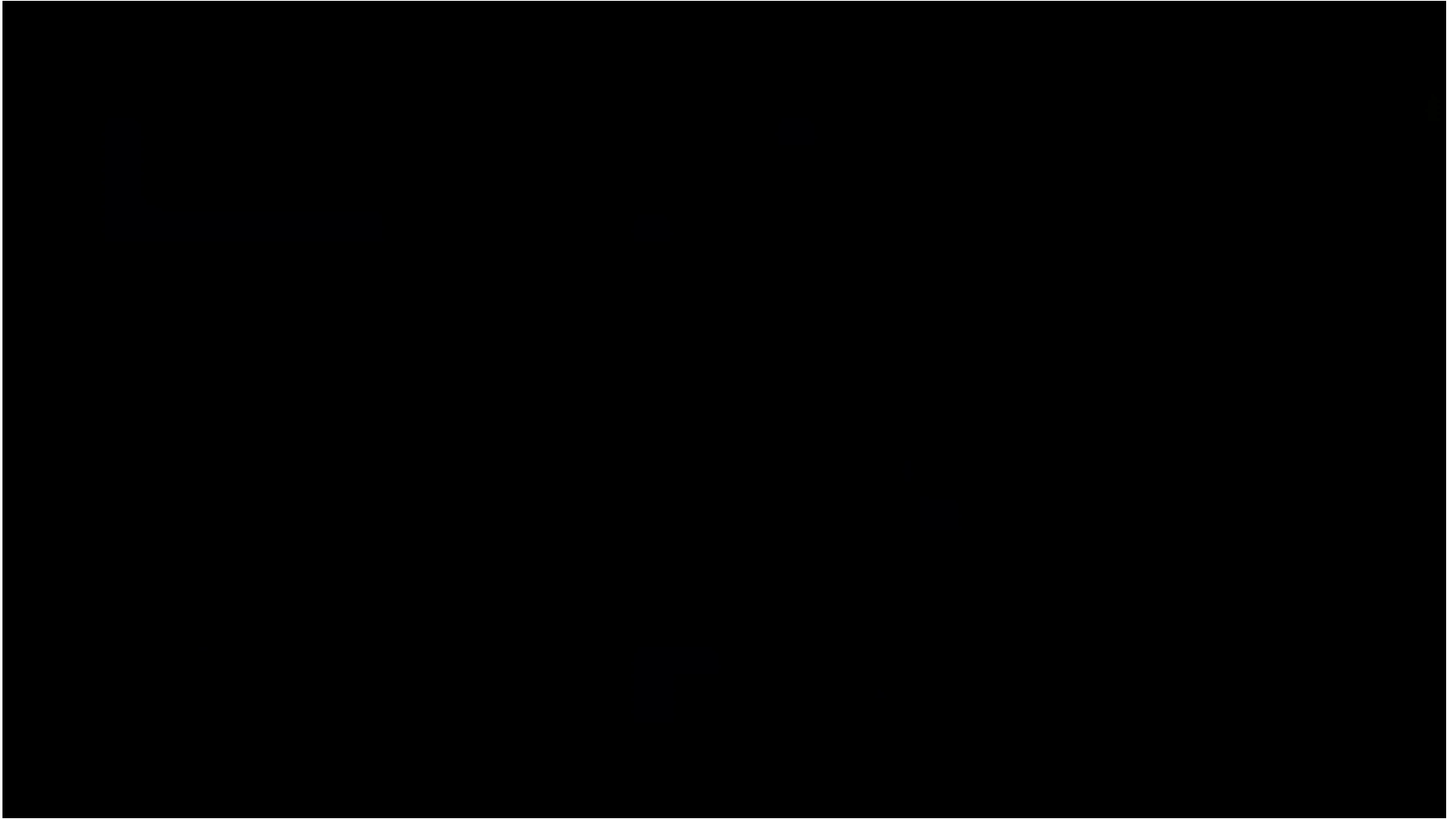
Periflo

Flowrox

Graco



Dual Disc Pumps



Dual Disc Pumps: Principle or Operation

- Dual disc pumps work similar to an air-operated diaphragm pump.
- A shaft drives two rubber “discs” which alternate strokes.
- Diaphragm action causes check to open and close allowing for flow of material.



Dual Disc Pumps

Features and Benefits:

- Can run dry
- Low cost maintenance
- Can be simple and easy to repair
- No seals of any type are required
- Great tolerance for rags, solids, fibers and abrasive media
- Self-priming



Dual Disc Pumps

Disadvantages:

- Solids up to approx. 3-4% concentration
- Produces low discharge pressures
- Requires use of inlet stabilizers and pulsation dampeners to optimize the entire system
- Can be difficult to maintain



Dual Disc Pumps

Popular Brands:

SSP/Alfa Laval

Penn Valley

WasteCorp



Positive displacement pumps are excellent choices for pumping even the most arduous sludge:

- Slower speed pumps means less damage from abrasion caused by grit.
- Heavy, viscous liquids are no problem for P.D. pumps.
- The ability to pull suction lifts gives the owner more selections on pump locations.
- Solids handling capabilities compensates for materials NOT picked up in the headworks.
- Repeatability or metering gives the owner accurate flow information.
- The ability to generate high discharge pressures makes the P.D. pump an excellent selection for moving sludge great distances.



Questions?

