

CHAPTER FIVE

Pump selection guidelines and pump system design

Before the selection of a pump that will fit needs, four things must be known :

1. The total head or pressure against which it must operate,
2. The desired flow-rate,
3. The suction lift, and
4. Characteristics of the fluid.

- To get the most efficient pump, an analysis should be made of all pumping requirements.

Key points to consider are:

- Net positive suction head (NPSH)
- Priming
- Flexibility
- Corrosion
- Useful life
- Maintenance
- Quantity pumped
- Pumping head
- Power source
- Economics.

Fluid Properties

The properties of the fluids being pumped can significantly affect the choice of pump.

- **Acidity/alkalinity (pH) and chemical composition.** Corrosive and acidic fluids can degrade pumps, and should be considered when selecting pump materials.
- **Operating temperature.** Pump materials and expansion, mechanical seal components, and packing materials need to be considered with pumped fluids that are hotter than 200°F.
- **Solids concentrations/particle sizes.** When pumping abrasive liquids such as industrial slurries, selecting a pump that will not clog or fail prematurely depends on particle size, hardness, and the volumetric percentage of solids.
- **Specific gravity.** Specific gravity affects the energy required to lift and move the fluid, and must be considered when determining pump power requirements.
- **Vapor pressure.** Proper consideration of the fluid's vapor pressure will help to minimize the risk of cavitation.
- **Viscosity.** Since kinematic viscosity normally varies directly

PUMP SELECTION & PUMP CURVE

- The selection of a pump for a particular condition should be approached with as much information as possible about the conditions under which it will operate.
- One piece of information necessary is the total dynamic head, which consists of the sum of all heads that the pump must overcome in its operation, the flow-rate to be moved, size of well casing (if needed), the revolutions per minute (rpm) of the power source, and the depth of setting.
- With this information, the operator can make a decision of the type of impeller that would be the most efficient and use the least energy.

➤ The following information may be found on a pump curve:

Size of Bowl: The pump curve contains the diameter of the bowl. If the bowl is too large, it may not fit into the well casing.

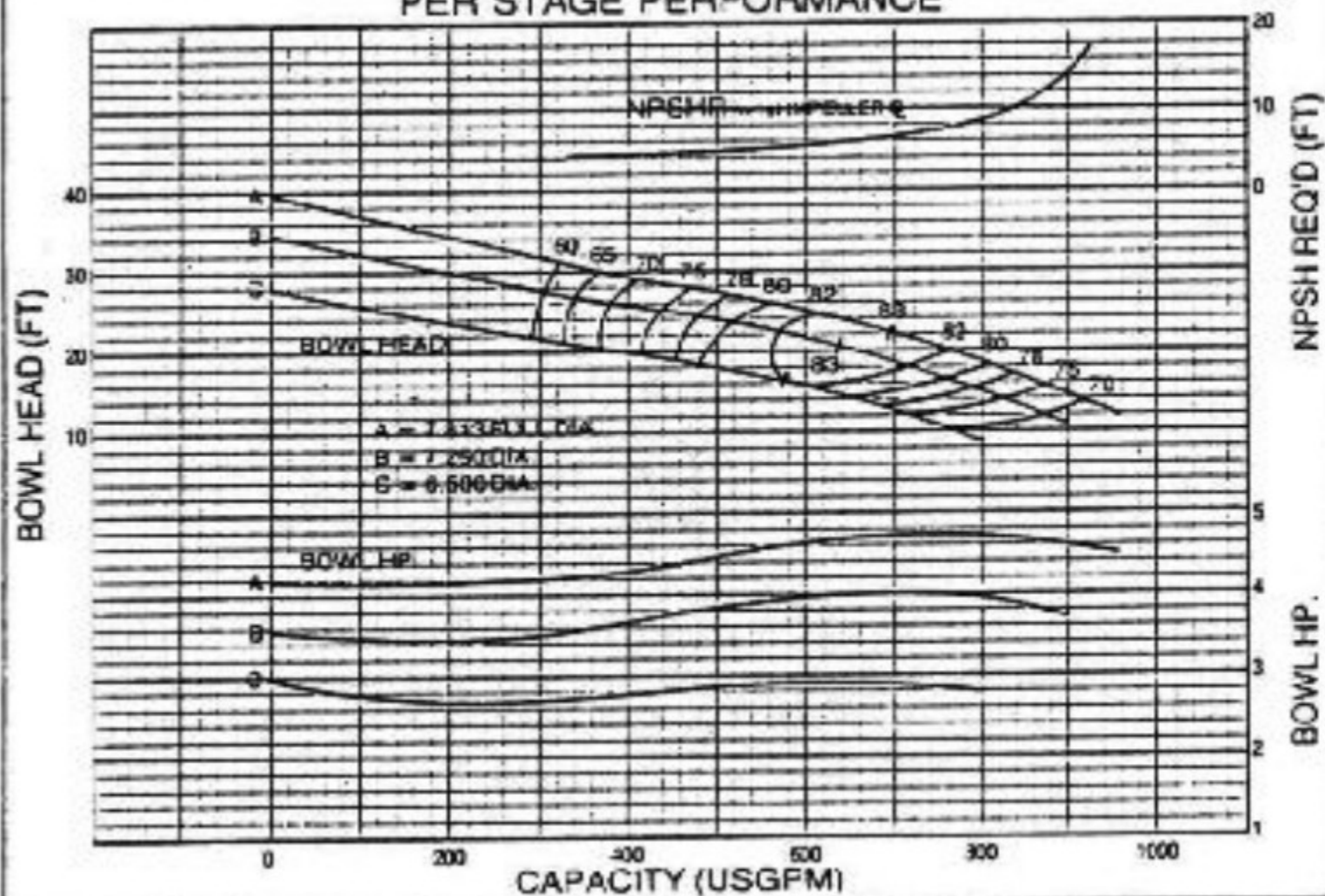
Size of Impeller: The size of the impeller will also be on the pump curve sheet. Shown by an A, B, or C on the curve, this indicates the trim, or size, of the impeller. The A curve shows the characteristics of a pump with the largest diameter impeller, with the impeller for the B and C curves decreasing in size.

Bowl Head: The curve indicates the head that one impeller will overcome. This information is contained along the right-hand side of the graph.

Capacity: The flow in gallons per minute is along the bottom of the graph.

Pump Efficiency: Efficiency should be a top priority in the selection of a pump. The pump efficiency is found by drawing a line from the gpm that is expected from the

PER STAGE PERFORMANCE



PUMP OPERATION AND MAINTENANCE

- Contamination problems are often attributable to substandard greasing practices or to water contamination from flooding or excessive packing leakage.
- Lubrication of the pump should follow the recommendations of the manufacturer.
- All fittings and grease cups should be cleaned before greasing to remove any dirt that has built up on them.
- The relief plug should be removed from the bearing.
- This allows the old grease to be removed from the bearing case as the new grease is pumped in.
- This practice prevents the old grease from entering the windings of the motor.

Pumping system problems

- Some pumping system problems are sufficiently expensive to justify a system assessment.

Examples of these problems include inefficient operation, cavitation, poor flow control, and high maintenance.

Inefficient Operation: Inefficient system operation can be caused by a number of problems, such as improper pump selection, poor system design, excessive wear-ring clearances, and wasteful flow control practices.

Indications of inefficient system operation include high energy costs, excessive noise in the pipes and across valves, and high maintenance requirements.

Cavitation: Centrifugal pumps are susceptible to a damaging and performance-degrading effect known as cavitation.

- Cavitation occurs when the static pressure in the pump drops below the vapor pressure of a fluid.
- The liquid vaporizes in the form of tiny bubbles; then, when the surrounding pressure increases, the fluid returns to liquid as these tiny bubbles collapse violently.
- The collapse of the bubbles sends high-velocity water jets into surrounding surfaces, which can damage the impeller and erode the pump casing and piping surfaces.
- When a pump experiences cavitation, the result is accelerated bearing and seal wear and poor system performance.

Internal Recirculation: Internal recirculation is another performance-degrading effect that damages pumps in much the same way that cavitation does.

- Internal recirculation tends to occur at low flow rates when fluid leaving the impeller forms damaging vortices. To avoid this problem, manufacturers list the minimum flow rates for their pumps.