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PUMPS FOR ANY APPLICATION

PEERLESS PUMP®

LaBour Taber

Opening Slide

PEERLESS PUMP®

LaBour Taber

Centrifugal Pumps
Systems Characteristics

Communication

- Production
- Engineering
- Maintenance
- Supplier

20 Year Life Cycle Costs

- +/-5% --Equipment Costs
- +/-15%-Installation
- +/-40%-Operation HP
- +/-40%-Parts & Labor

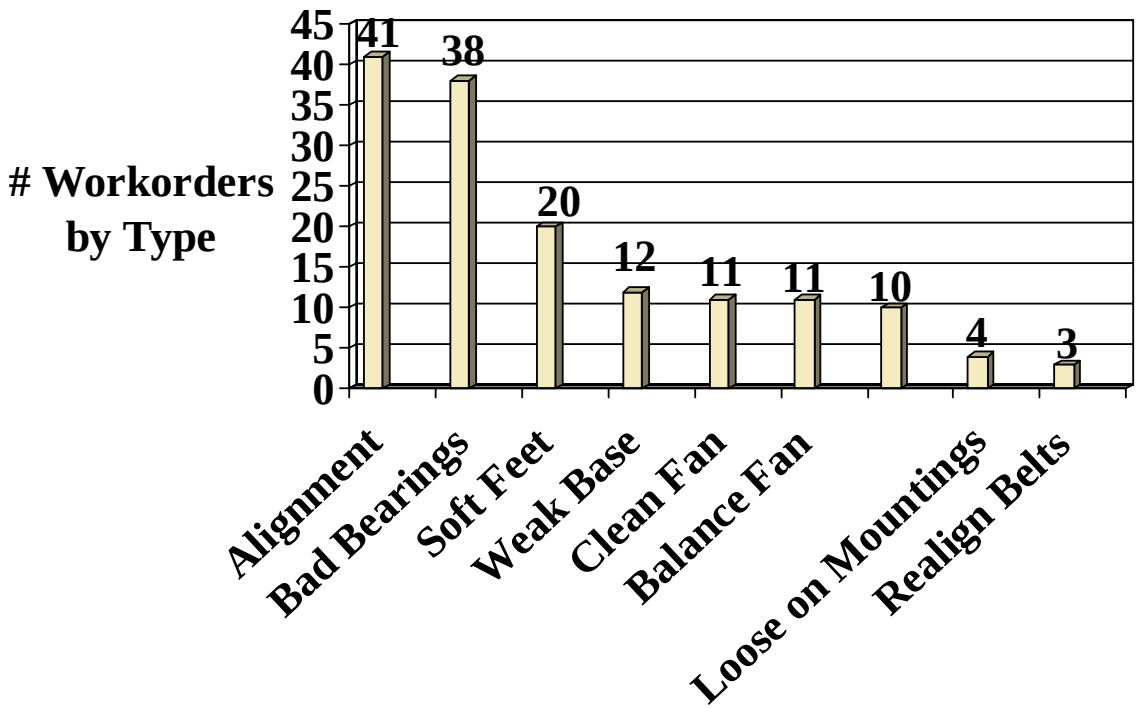
Matching the Pump To the System Benefits

- Energy savings- $400-1000/hp/yr
- Extended Pump Life due to Reduced
- Internal Wear
- Minimal Radial Loads
- Longer Valve Life
- Stable Hydraulic Output

MTBF
Centrifugal Pumps

- Phase I- 6-8 months on average
- Phase II- 12-16 months on average
- Phase III- 2+ years

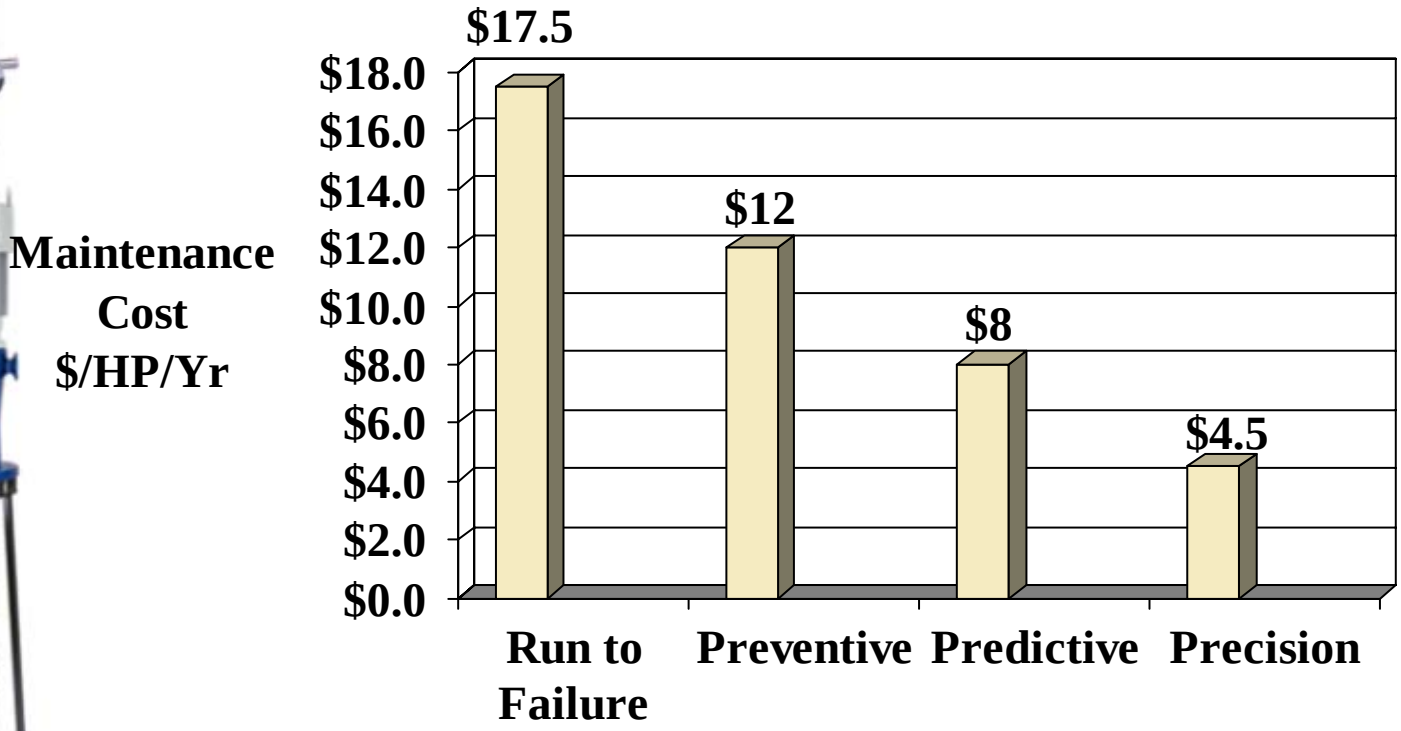
Millwide Vibrations Problems



External Considerations

- External Conditions
  - Hydraulic Operating Conditions
    - Flow Rate
    - Pressure
    - Turbulent Flow
  - Installation Practices
    - Piping
      - Configuration
      - Alignment
      - Support
    - Base
      - Size and Style
      - Grouting
  - Drive Train
    - Coupling
      - Size and Style
      - Alignment
    - Driver
      - Size
      - Speed

Maintenance Cost Comparisons



System Head Curve
Total System Head

- Static
- Friction
- Velocity
- Pressure

Hydraulic Match
Fit of Pump to System

- To have a successful installation we must properly match the pump(s) to a system.
- Therefore we must be able to create a system head curve on which we can plot the pump performance curve, showing, single, parallel and if applicable series pump operation
- It is the intersection of the pump & system curve that determines where the pump actually operates on it's performance curve

System Head Curves
Critical Concerns

- What will happen if the pump wears so head is down 5%?
- What will be the effect of a change in pressure in the tank into which the pump is pumping?
- What will happen if deposits form in the piping?
- What will happen at Max/Min levels in the suction tank?

System Head Curve Definition

- By definition, the system head curve shows the head required by the system at various flow rates
- The pump operates where its curve intersects the system head curve

System Head Curve Components

- Static or pressure head (pumping up a hill, pumping into a boiler, etc) .
- This head does not change with flow.
- Friction Head. This head increases with the square of the flow. This head increases with the fifth power of the pipe diameter.

System/Pump Consideration
Consider the Effect of:

- Change in pump curve
- Change in static or pressure head
- Change in friction head

Note: That the greater the angle of intersection between the pump and system head curve, the less the effect of a change in either curve.

System Head Variables (1)

- Static Head will vary as a result of change in elevation of highest point of discharge of the system

System Head Variables (2)

Friction Head at any specified flow will vary as a result of:

- Change in viscosity resulting from a change in liquid temperature
- Deterioration of the piping system
- System differences between design and “as-built”
- Accumulation of solids in the system
- Load distribution
- Friction losses tabulation procedures

Parallel Pump Operation
Flow Additive

- Draw a combined pump curve - add flows at constant head

Factors in Parallel Operation

- Shutoff Head
- Curve Shape
- Relative Sizes

Advantages of Parallel Operation

- Flexibility
- Installed Cost
- Operating Cost

Series Pump Operation
Pressure Additive

- Draw a combined pump curve- add the pressures(head) at constant flow

Factors in Series Operation

- Pressure Rating of the Pump Casing
- Pressure Rating of the Piping & Components
- Curve Shape

Advantages of Series Operation

- Installation/Equipment Cost
- Flexibility in Design
- Operating Cost

System Head Curves
Classification of Systems

- Nonreturn Systems-

  Where all the liquid is discharged from the system
- Return Systems-

  Where none of the liquid is discharged from the system

  Where some of the liquid is discharged from the system

System Classifications
Thermal Exchange Applications (1)

Thermal exchange, where some form of thermal exchange is conducted for the purpose of satisfying a design condition

System Classifications
Thermal Exchange Applications (2)

- Chilled Water
- Cold Well
- Condenser Water
- Cooling Tower
- Heat Recovery
- Hot Well
- Mill Roll Cooling
- Plant Circulating Water
- Plant Cooling Water
- Spray Pond
- Strip Mill Quench

Removal/Delivery Applications (1)

Removal/Delivery, where the system is designed to remove the liquid from or deliver it to some point to satisfy a specific design service

Removal/Delivery Applications (2)

- Ash Sluice
- Boiler Feed
- Condensate
- Domestic Water
- Effluent
- Filter Backwash
- Flood Irrigation
- High Service
- Low Service
- Municipal Booster
- Raw Water
- River Intake
- Sewage Ejector
- Sprinkler Irrigation
- Storm Water
- Charge

Pump Characteristic Performance Curve

- Normally a constant speed plot
- Axes- Flow (gpm), Head (feet)
- Plot of efficiency, head capacity at constant diameter, BHP at 1.0 S.G., NPSHR
- Note effects of specific gravity on head, pressure, BHP, suction pressure, viscosity on performance
- Note the various head-capacity curve shapes based on different pump types:

  Axial Flow

  Mixed Flow

  Radial Flow

Oversized Pump Retrofit Savings

- Design is 1000 gpm at 315 ft tdh actual BHP is $48,000
- Valved back to 650 gpm and operating at 420 ft tdh, actual BHP is $40,000
- Resize pump for rating of 650 gpm at 230 ft tdh, actual BHP is $22,300
- The actual cost of resizing pump is $4,560
- The BHP $ savings of $40,000 – 22,300 = $17,700, or payback in 2.5 months!!!!!

Centrifugal Pumps
Operating Zones (1)

- Overcapcity Zone- The velocities within the pump are usually very high and recirculation occurs causing excessive wear in the presence of solids. The radial hydraulic loads on the impeller increase exponentially within a single volute casing
- Recommended Operation Zone-The velocities within the pump are reduced. Recirculation is minimal and the flow in the suction nozzle should be axial(not induced vortex). The radial hydraulic loads are minimized.

Centrifugal Pumps
Operating Zones (2)

- Reduced Capacity Zone- The velocities within the pump are low, separation and recirculation occurs causing excessive wear in the presence of solids. Reducing the capacity should be limited because a certain minimum velocity must be maintained to avoid settling out of the solids; with the consequence of increased wear and clogging. The hydraulic radial loads will increase exponentially and the pump efficiency will decrease.
- Shut Valve Zone- This is the point of zero flow, and pump should not be operated at this point for any length of time. Wear and tear will be rapid dud to separation and recirculation, the hydraulic forces will be at their highest, and settlement and plugging will occur. The pump will rapidly heat up, which is particularly serious in pumps, especially those of non-metallic construction.

Centrifugal Pumps
General Guidelines
Selection & Application

- Types of Pumps- Kinetic-Centrifugal
- Materials of Construction-Temperatures & Concentrations
- Corrosion & Erosion
- Galling
- Minimum & Maximum Hydraulic Conditions
- Non-Overloading Motor
- Suction Conditions-Cavitation & Minimum Submergence
- Entrained Air
- Solids Handling
- Vibration Requirements
- Bearing B-10 life
- Shaft deflection Requirements
- Sealling Requirements
- Maintenance Requirements
- MTBF Requirements

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