Best Practices for ANSI Pumps

Seven Principles to Extend Process Pump MTBPM

Increase mean time between pump maintenance (MTBPM) and reduce total cost of ownership by mitigating internal stress and vibration in centrifugal process pump systems.

Seven Principles for Improved ANSI Pump Performance and Reliability

Selection

- Since induction motors have operating speeds 2% to 5% below synchronous speed, size pumps to run at operating speeds less than stated maximum synchronous speeds.
- Impeller trims of 75% are optimal, so trim impellers 60% to 95% of maximum.
- Operate pumps at 85% to 110% of best efficiency point (BEP).
- Ensure NPSHA is 20% or 1.5 m (5 ft) over NPSHR, whichever is greater.
- Consider employing variable speed technology for multiple operating point conditions.

Balancing

- Balance impellers to 0.312 g/kg (0.011 oz/lb) after trimming. When OD-to-width ratio is < 6, spin balance in two planes. When OD-to-width ratio is ≥ 6, single plane balancing will suffice.
- Use couplings balanced to AGMA 8 for motors 55 kW (75 hp) or less; or AGMA 10 for motors greater than 55 kW (75 hp). Elastomeric couplings are recommended for soft start.
- Offset pump and motor shaft/coupling hub keyways by 180°. Cut keys to one-half the keyway length.

Installation

- Level pump, base and motor and ensure the area is free of soft foot conditions.
- Provide at least 10 diameters of straight pipe to the pump's suction inlet. Consider using flow conditioning technology as an alternative.
- Use highly rigid baseplates, such as reinforced stilt or grout installed designs.
- Utilize low-shrink grout to install baseplates. Epoxy grout is superior, but requires special cleaning and a primer to effectively bond with the base.
- Design piping to ensure minimum stress, i.e., fasteners should be installed without force.

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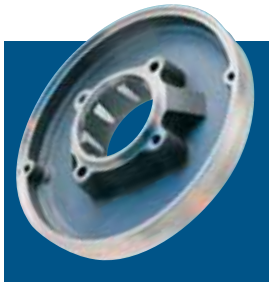
Alignment

- Employ laser or reverse dial indicator technology to align pump and motor. Recommended tolerances are 0.051 mm (0.002 in) FIM parallel and 0.0127 mm (0.0005 in/in) FIM angular.
- Align before and after the pump and piping are bolted together.
- Specify that bolting which connects pump to pipe must fit without force.
- Consider using C-flange motor adapters when pumping fluids hotter than 95°C (200°F) or when the pumping fluid temperature fluctuates more than 55°C (100°F).
- For pumping temperatures greater than 175°C (350°F) consider centerline mounted casing and use a C-flange adapter when temperatures exceed 260°C (500°F).

Operation

- Refer to start-up procedures and checklists in user instructions (lit no. 71569102).
- Slowly close process valves to avoid water hammer.
- Use a power monitor to ensure minimum and maximum flow protection.
- Add a minimum flow bypass as needed.
- Consider soft start for frequent on-off duty pumps. Variable speed technology, such as Flowserve Tempo IPS, inherently provides soft start, optimal speed and increased efficiency.
- Avoid run-dry conditions. Check for submergence conditions, particularly in batch operations. If run-dry conditions are possible select pumps and seals able to withstand such conditions.
- Operate spare pumps at least every three months to maintain proper working condition.

Preventive Maintenance



- Change lubricant at recommended intervals.
- Protect lubricant from contamination. Consider a Durco ANSI 3A™ power end.
- Use sealed or vapor block power end protection with a synthetic lubricant to extend relubrication intervals.
- Maintain mechanical seal flush environment or consider using alternative seal and seal chamber designs.
- Perform power end and mechanical seal maintenance in a certified clean room.
- Predictive maintenance, vibration monitoring and lubricant analysis are beneficial practices.

Design and Specification

- Use solid shafts to minimize deflection and the associated seal and bearing failures.
  - For Group 1 pumps use shafts with $L^3/D^4 < 75$.
  - For Group 2 pumps run at 3500 RPM use shafts with $L^3/D^4 < 40$.
  - For Group 2 pumps run at 1800 RPM use shafts with $L^3/D^4 < 65$.
  - For Group 3 pumps use shafts with $L^3/D^4 < 25$.
- Maintain critical impeller clearance to minimize thrust loads and seal chamber pressure.
- Use cartridge seals to ensure proper setting and to reduce fretting.
- Specify seal chamber designs with anti-rotation features that reduce abrasion, vaporization, heat and cavitation at the mechanical seal.
- Require the pump manufacturer to be responsible for the total engineered seal system.
- Specify rigid, cast iron motor foot construction with ≥ 182T (S) frame sizes.

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