GPM INC.
SOLUTIONS DRIVEN™

White Paper

Specify the Right Pump for Industrial Applications

Choosing the right pump isn't just about avoiding costly mistakes; it's the key to unlocking peak performance. The pumps used for wastewater treatment, oil refining, mining, steel manufacturing and other industries are essential to keep operations running smoothly. Specifying the wrong pump can be catastrophic, causing errors leading to failure and downtime. It is not only a profit loss issue but also a safety issue. That is why specifying the right pump from the start is essential.

Considering your pumping requirements early in the project planning stage is critical. Pump failure is a looming possibility when an incorrectly sized pump is in play. It's not just a minor hiccup; diagnosing the problem, acquiring and installing a correctly sized replacement can quickly become a costly endeavor, especially if the pump has already failed and brought an entire operation to a grinding halt. If the internal workings of the pump—mechanical seals, bearings, casings, impeller, etc.—aren't customized to the application at hand, it's not a question of if a pump will fail but when.

Vital Factors for Specifying a Pump

In order to select the correct pump, you must take into account:

- Type of process (what is being pumped?)
- Flow (desired/required)
- Head required (feet or PSI). If head cannot be provided, system design information is needed:
  - Pipe type and diameter
  - Length of horizontal pipe
  - Vertical difference
  - Number of fittings
  - Fitting type
  - Fluid properties
- Percentage of solids
- Specific gravity
- Fluid type
- pH range
- Type of solids
- Solid diameter (max)
- Electrical items
  - Are there horsepower requirements?
  - Will the pump be operating with/without a VFD?
  - Voltage requirement
- Ambient condition

Avoid These 4 Common Pump Specification Mistakes

1. Incorrect Sizing

If a pump is not meeting the expected performance range because demands increased or it required unexpected maintenance, incorrect sizing may be the culprit. To maximize mean time between failures (MTBF), pumps, if adequately sized, should be run between 70% and 115% of the best efficiency point (BEP) (see Figure 1). Operating within the BEP range minimizes radial loading and shaft deflection, improving the life span of the various wear parts such as bearings, impeller rings, and mechanical seals. Different types of cavitation may occur while operating a pump farther away from BEP, along with a shorter MTBF due to bearing and seal failures often caused by increased radial loading, thus increasing shaft deflection.

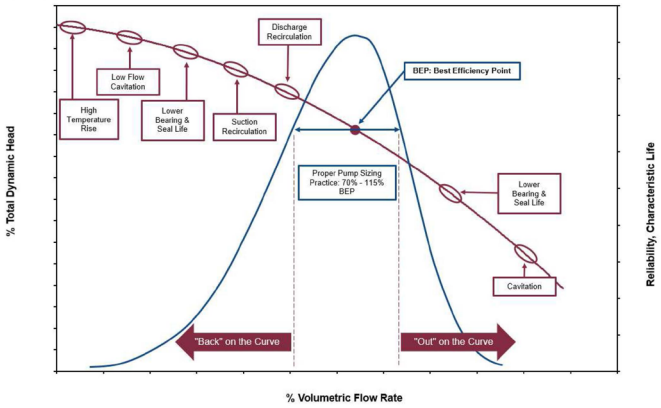


Figure 1: Pump Operation Point vs. Reliability

Oversizing a pump is common. It often occurs when multiple project stakeholders add to the safety margin. There are factors of a project that are unpredictable when it comes to sizing pumps for an application; those factors are accounted for by a safety margin being added to help guarantee that the pump will achieve the intended performance. This often leads to oversizing the pump and causes a higher likelihood of cavitation, resulting in extreme wear on the impeller veins' outermost edge and decreasing overall pump efficiency over time.

When sizing a submersible pump, sump management is key to a successful application. After sizing a submersible pump correctly for the piping system to the discharge point, be sure to assess the sump size. A motor can run warmer if it's not submerged, but it

also generates significant heat during start-up. Knowing the flow and the overall size of the sump helps determine the correct pump to use. Motors are rated for a certain amount of starts per hour and exceeding this can lead to excessive heat and shorter motor life. If the pump is set to start/stop from level control in a smaller sump, the pump may turn on and off frequently, causing increased insulation breakdown on the motor windings. Understanding what's coming into the sump and how the pump will be operated becomes critical to overall pump success.

Having a knowledgeable and trusted pump partner involved from the start can prevent this mistake before it happens. It's essential to carefully consider the overall system profile and factors, including but not limited to flow rate, total dynamic head, pump media and viscosity (clean water vs. slurry or sludge), fluid temperature, pH range, specific gravity, solids percentage, and safety margins during the pump selection process.

2. Not Planning for the Future

System conditions may change over time due to process requirements, and if you don't plan, the original pump specified may no longer be a fit. When not properly sized for an application and changing duty conditions, pumps see extreme vibration, suction or discharge cavitation, and air entrainment. Two or more of these factors often happen simultaneously, causing excessive wear on the pump.

For example, considering potential elevation changes would be beneficial when sizing a pump in quarry or mining applications. Additionally, in pulp and paper, there is commonly an increase in production capacity; this, too, should be considered when properly sizing a pump for the application.

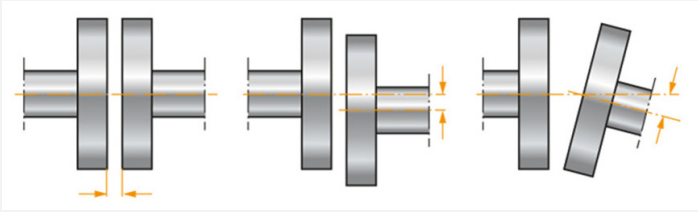
To additionally combat mistakes as they pertain to system growth when purchasing a replacement pump for the old, outdated one, check up on the parameters of your system to ensure nothing has changed before repurchasing a pump at the same duty point as the prior pump.

3. Incorrect Installation

Ensuring your pump is installed correctly is one of the most critical parts of a pumping system and meeting the application's pumping requirements. There are several common issues in the installation process: electrical, misalignment, soft foot, and pipe strain.

It is common to incorrectly wire the pump during installation, resulting in improper impeller rotation. It happens more than we'd like to admit, and the pumps continue working even when the impeller rotates in the wrong direction. When this occurs, efficiency and head requirements may not be met. Always double-check rotation direction during installation and perform a bump test to ensure the impeller is rotating correctly. The pump's operating point should be evaluated after correct rotation is assessed.

Misalignment, as it relates to pumps and pumping systems, can happen in many ways. The first is coupling misalignment. Coupling misalignment occurs when the coupling components are assembled with the shaft centerlines either too close or too far away from each other and/or aren't parallel. There are three common types of misalignments in this way: axial misalignment, radial misalignment, and angular misalignment.



AXIAL MISALIGNMENT RADIAL MISALIGNMENT ANGULAR MISALIGNMENT

Figure 2: Common Misalignments

These forms of misalignment affect the pump's lifespan as they can cause overheating, excess noise and vibration, and loss of efficiency. See Figure 3 to see the excessive amounts of heat generated by misaligned couplings. Misalignment also is fatal to critical internal pump components such as the shaft, bearings and seals.

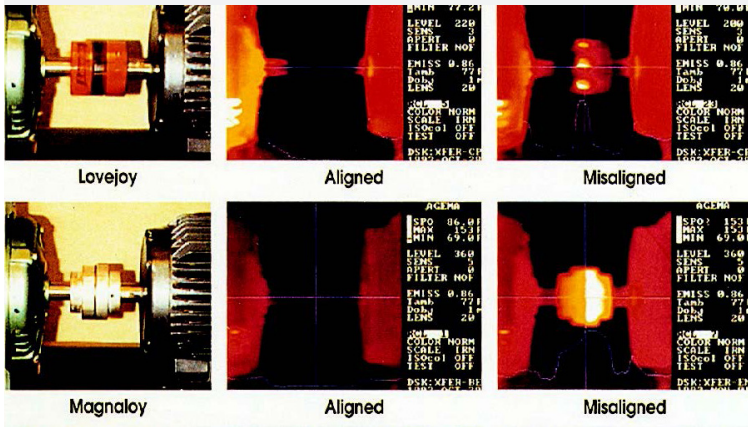


Figure 3: Misalignment Heat Generation

Soft foot misalignment is often a culprit in causing shaft misalignment. Soft foot occurs when the pump is installed, and not all "feet" sit flat on the supporting base. When the feet are bolted to an uneven base the pumps inside components, such as the shaft, bearings and seals can become misaligned. When installing

a pump, it is crucial that the base is completely flat, and the pump is securely installed via the mounting points on the pump's base. You can check for soft foot misalignment by using a feeler gauge beneath each foot to ensure there is no space for excess vibration.

Piping problems commonly occur on the suction side of the pump. The ideal suction side piping will have a straight run of pipe, anywhere from 5 to 10 times the pipe diameter. This promotes linear flow into the pump's suction, preventing air entrainment and cavitation.

Additionally, when installing a submersible pump, it is important to consider the cable. Protecting the cable is critical to a submersible pump's long-term success. Damaging a cable can lead to a premature failure by allowing water intrusion into the motor. Avoid sharp edges or pinch points when routing out of a sump or pit, and prevent twisting or wear by protecting the cable from any sump agitators or moving items.

4. Overlooking System Challenges

If you're having an issue meeting the desired efficiency and flow rates, keep in mind the pump itself may not be the culprit. Many factors affect a system's efficiency and they frequently relate to the overall system conditions. Often, a component in the greater pump system, such as piping or valves, is not working correctly or is under/over-utilized.

The first issue to look for is blockages or obstructions in the piping or valves downstream of the pump. Blockages can be caused due to debris, scale buildup, sediment, or other foreign objects. Secondly, ensure the piping and valves are sized and are functioning correctly. Misalignment, corrosion or valve damage can equally contribute to flow inefficiencies. If system requirements increase over time and added flow is needed, you may consider increasing pipe diameter, especially when pumping slurries. If clogging and obstructions are common within your system, implementing a continuous monitoring system that tracks vital parameters such as flow rates, pressure and temperature may be necessary. A tool such as a flow meter assists in identifying these issues as they arise and allows for timely intervention.

If your team doesn't know exactly what to look for, consider engaging an experienced field service team. Having a local pump expert inspect the entire system will allow them to analyze the root cause of the problem quickly, limiting downtime.

GPM has proudly served 45 years in the pump industry, specializing in manufacturing the toughest and most reliable submersible slurry pump line, the GPM-Eliminator™. These pumps have found applications in over 12 different industries, including process pumping, taconite handling and dewatering, among others.

With GPM's knowledgeable assistance, customers can avoid incorrect pump sizing, motor failure, unplanned maintenance costs and unexpected downtime. We integrate modern technology into our specification process to meet the industry's evolving systemic needs. Our team serves as dedicated project leaders, navigating customers' projects from an idea to a working system with full transparency throughout the process.

Your Full-Service Pump Partner

In addition to being the OEM of the GPM-Eliminator™—the world's toughest slurry and dewatering pump lineup— we also have a skilled team of talented engineers, skilled designers and knowledgeable assembly teams who work together to build out custom pump systems for increasingly complex projects. If you cannot find a pump system that fits your specifications, GPM's Engineered Fabrication team will design, engineer and build the exact system you need.

We customize each design to suit our customers' unique requirements. Factors such as hydraulic characteristics, space limitations, system integration and mounting options are all crucial to guarantee that the pumps and pump systems we supply meet the functionality and performance criteria required for each project.

We don't just define ourselves as experts; we're dedicated collaborators. Our mission is to work hand in hand with you and your team to ensure we deliver the correct pump or pump system. Whether it's one of our renowned GPM-Eliminator pumps or another quality brand we distribute, we're committed to minimizing downtime for our customers. Our customer-first approach sets us apart in the industry. We're happiest when our customers and their operations are running at peak capacity, with downtime reduced to the bare minimum.