Material Matters

New Rubber Liners with Ceramic Rods Improve Pump Performance and Wear Life

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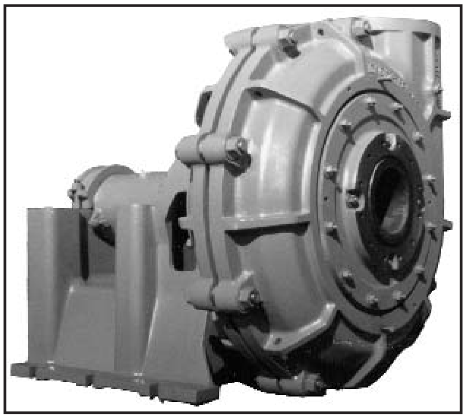
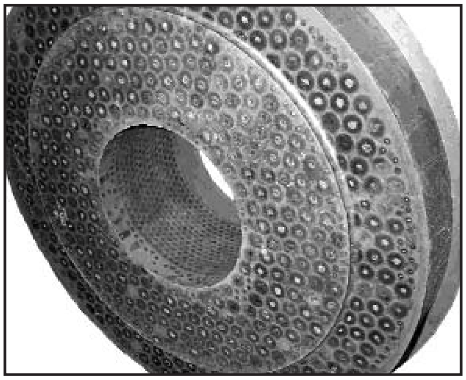
Soft Rubber Lined slurry pumps were developed by Allis-Chalmers in 1918 to fill the fluid handling needs of the emerging American mining industry. The ITT A-C Pump Model SRL has evolved from these early lined pumps and has been successfully used for various industrial slurry applications. Rubber liners work best when the particle sizes of the solids in the slurry are very fine. As the particles become coarser, hard metal slurry pumps are preferred. However, hard metal pumps and parts are much more expensive compared to the ones with rubber liners. A life cycle enhancing solution was required.

In mineral processing, the primary and secondary ore grinding circuits such as the SAG and ball mill discharge are brutal on slurry pumps. Rubber-lined pumps have been very successful except that the suction wear plate liner often wears out early due to the high solids content. Hardened high chrome wear plates extend the life by about 50% but cost almost three times as much as rubber.

The very nature of the parts wear life was such that for each change-out of the casing liner set, approximately two impellers and four suction wear plates are consumed. This created a need for a longer lasting material to increase the wear plate life and mean time between maintenance cycles. The goal was to combine the abrasion resistance of the hard wear face with the resilience of the soft rubber to cushion the impact. The first development cycle consisted of a hard metal plate bonded to the rubber liner. The plate thickness and the bond strength limited its success. Next, multiple layers of 10-mm ceramic beads were molded into the wear plate face. This extended the wear life but smaller cross section of the beads limited any further improvement. Finally, 20-mm ceramic rods were placed close together on the wear face and molded with rubber under high pressure. Part of the development challenge was to locate and keep the ceramic rods in place as they tended to shift during the molding process. Once an exclusive process was developed to accomplish this, the liner was tested with great success.



(Illustration 1) Model SRL Rubber Lined Slurry Pump



(Illustration 2) Ceramic Rod Media suction plate doubles the service life of the parts.

In one application, a 10x10-28 SRL-XT on mill circuit duty, the natural rubber suction wear plate and impeller lasted 18 and 21 days respectively. A suction wear plate with 10-mm ceramic balls was manufactured and tested. The wear plate life increased to about 22 days with corresponding increase in impeller life. Next, the wear plate was manufactured using 20-mm ceramic rods carefully positioned on the suction wear plate face. The life of both the wear plate and impeller nearly doubled to over 37 days. The wear life of the casing liners also improved slightly to over 45 days. Since the CRM (Ceramic Rod Media) suction wear plate (Illustration 2) retained its geometry longer, fewer impeller adjustments were necessary and original pump efficiency was sustained during the wear cycle.

This CRM liner costs less than hard metal and lasts about two to four times as long offering excellent value to the customer. Additionally, the increased life of the impeller helped all of the components to wear equally and evenly with sustained higher efficiency. This increased the MTBM with reduced repair costs and energy savings.

Results of field tests against competitive metal slurry pumps were so dramatic that they eventually led to replacement with SRL pumps with CRM liners.

Service Solutions

Technology Solutions for Rapid Manufacturing

Randall Jansen
Master Black Belt
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To ensure that ITT PRO Services can provide its customer with the best delivery solution to a variety of situations they have made a firm commitment to apply the latest technologies. Using leading edge technology PRO Services has developed a process to meet your requirements. It doesn't matter if there is a drawing, pattern, or obsolete part in service today. The integration of technologies into this proven process cuts time, cost, and adds the quality.

The economic pressure of systems being down demands an immediate solution. Downtime is not only expensive due to lost production but can also be costly to your company's reputation. A single component failure can result in missed shipments and disgruntled customers. If your Original Equipment Manufacturer (OEM) can't deliver in an

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Figure 1, Scanning part using CMM

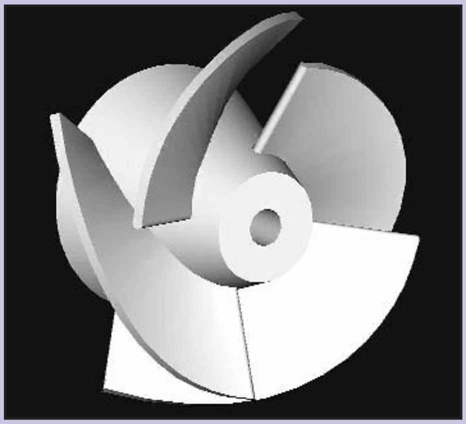

Figure 2, Pro/Engineer design model

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acceptable time period, where do you procure and industrial part, at a reasonable cost, and get OEM quality and performance? ITT Pro Services may have the solution.

At the heart of the PRO Service solution is the latest in portable coordinate measuring machines (CMM) (fig 1). More often than not the best solution involves the PRO Service team going directly to their site. The team packs their equipment, and is on their way.

The process continues with the team setting up their equipment as close to the trouble as possible. Using the portable CMM equipment all critical design intent of the targeted component is captured by scanning the part and transforming it into digital information. The scanning function can be described as a process that creates a cloud of reference points in 3D space locating all boundaries of the part. The accuracy of this technology allows all features cast, fabricated, or machined to be captured and verified. In the next step the cloud of points is imported into the 3D-design environment. This is where the engineer takes over and transforms this accurate, but less than complete digital information into a virtual representation of the part (fig 2).

Having a digitally captured virtual representation (design model) of the final product has only gotten the team part way through the process. The primary method of manufacturing these parts involves one of a variety of casting processes. To accomplish this task the required machine stock allowances must be added, draft allowance that may no longer be present must be added, and any imperfections found on the original part removed from the design model. It's through the experience and expertise of the PRO Service engineer that this can be accomplished without compromising any of the original design intent.

The process of capturing the customer design data in the form of a design model cannot be taken lightly, because it is often the most time intensive part of the process. It is through a firm commitment to technology that the customer will see the rewards. Traditional pattern making techniques and paradigms is another of the biggest bottlenecks and expenses in the overall process. The traditional process is manually intense requiring highly skilled artisan's to convert the lines on a drawing to the desired design. It is through years of experience working with traditional materials of wood, glue, and screws that they can accomplish this task. Going through the process of creating a design model allows the use of "Rapid Pattern Manufacturing" technologies as part of the final solution. This process takes advantage of computers, machines, and new materials not traditionally used in the pattern making process. This shouldn't be confused with "Rapid Prototyping" because the final solution is an exact duplicate and fully functional part.

It all sounds a little like black magic, but this is a proven process that is used in the day to day solution by the PRO Services organization. Once the design model is created the model drives the remaining steps of the process. This example demonstrates the robustness of the process in extreme situations, but this solution can be used with any form of customer input data. While the above process has focused on the PRO Services organization we are incorporating this process into many of our business areas as part of our day to day business solution.

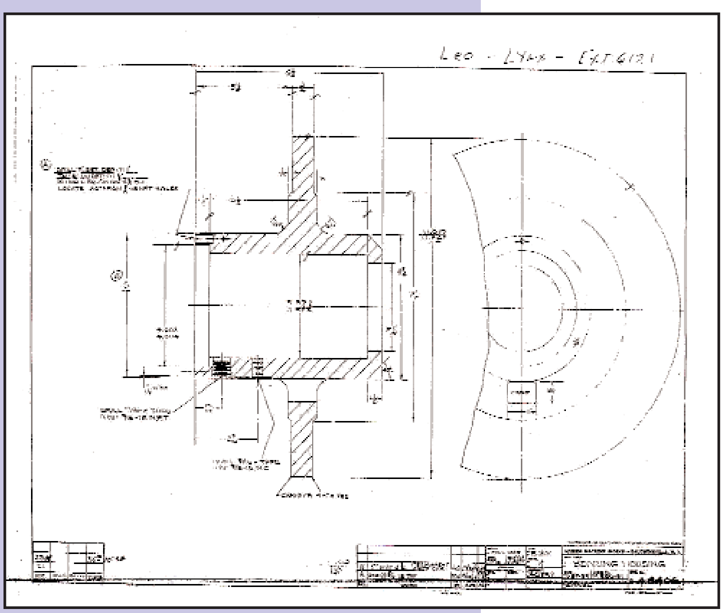

Figure 3, The required part

Testing the Process

The call comes in from the customer on Friday morning at 10:00 AM looking for a replacement part. After some quick investigation it was determined the desired part was obsolete, and the pattern equipment was no long in service. The good news was a drawing could be retrieved from the archive vault (fig 3). The drawing was retrieved, the part reviewed, and several solution approaches were discussed including not making the part.

At 2:00 PM on that same Friday the team had decided that by using the technology available and their new process, this part could be manufactured quickly and in a cost-effective manner. With the weekend on the way the first step was taken to create a Pro/Engineer design model. With the combined effort of engineering and manufacturing using a concurrent engineering philosophy the appropriate pattern equipment design was quickly determined and modeling began.

On the following Monday the model was complete and the "Rapid Pattern Manufacturing" process began. At 9:00 AM on Tuesday the pattern tooling was delivered to the foundry. The design of the tooling was a two piece configuration (fig 4) that eliminated cores and follow-boards in an effort to simplify the entire casting process. The concurrent engineering effort paid off and on day number five of the process the traditional no-bake foundry casting process took over.

On Friday, day number 7 the casting was complete (fig 5) and delivered to manufacturing to complete the remaining operations. The geometry of this part was not complex, and the size did not offer any manufacturing challenges. However, with history as proof this type of customer delivery opportunity to provide an OEM part was not often entertained. Traditional manufacturing practices often do not provide the speed and cost effective solution to make this a practical for the customer.

The key to fast manufacture of a casting is the rapid creation of quality pattern tooling. The principle that must be applied is to not make bad castings fast. By changing from traditional techniques the time it takes to create quality pattern tooling has been reduced from weeks to days and at a cost of 50% - 25% less than traditional wood pattern tooling. Another benefit of this process is the elimination of pattern life-cycle costs. These cost include storage, transportation, and repair of the tooling to a manufacturing capable state, all of which have an impact on the final part cost. In the event another part is required the digital design model is delivered to the "Rapid Pattern Manufacturing" process and a new quality pattern tool is created on demand. The degradation of casting quality due to the normal pattern tooling wear is eliminated. As

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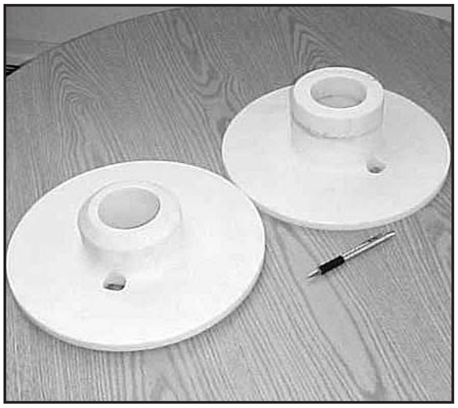


Figure 4, The two piece pattern tooling

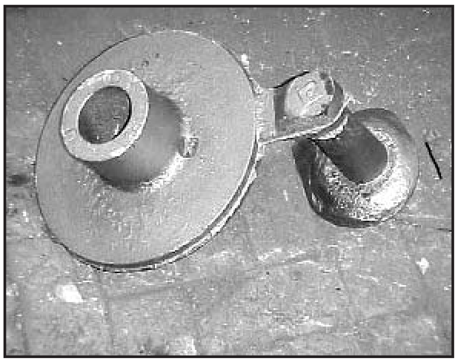


Figure 5, The casting ready for cleaning

with any process we must understand there are better fits for certain applications, and when we ignore this in our decision process we can pick the wrong solution. It is usually a combination of many factors like part size, geometry, material, surface finish, and application specific requirements that will assist in making the correct solution choice. Finally, "Rapid Pattern Manufacturing" principles can be applied to all designs, but the annual number of parts most often determines the final configuration and materials chosen. This will also impact how much pattern life-cycle costs can be reduced.

Conclusion

Rapid manufacturing is still in its early stages but is undoubtedly getting the attention of pioneering companies as a viable solution. The challenge lies in selecting the right process for the task by understanding limitations and strengths. At the same time key issues like physical consideration, operational consideration, and application consideration must be weighed. We must understand that you can't apply these technologies everywhere because they do have constraints. The challenge is to continue to test the limits of technology and identify new exciting applications and solutions to meet and exceed customer needs.

New Products

Goulds Pumps Introduces a New ANSI Metal Magetic Drive Process Pump

Teresa Parsons Product Manager - Sealless, Lined and Non-metallic Process Pumps
ITT Industrial Pump Group

Goulds Pumps is introducing a new ANSI metallic magetic drive process pump called the 3296 EZMAG in the fall of 2003. This represents an expansion of the successful model ICM, an ISO metallic magnetic drive process pump first introduced in the fall of 2000. The expertise of Goulds Pumps (USA), ITT Richter Chemie-Technik (Germany) and Vogel Pumpen (Austria) was used to create this optimum sealless pump.

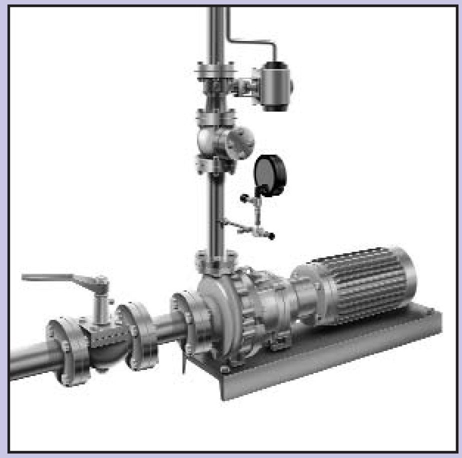
The robust, sealless 3296 EZMAG is designed to pump difficult fluids, such as corrosives, pollutants, ultra-pure liquids and toxics. There are many applications in the chemical process industry, including pharmaceuticals, specialty chemicals and agricultural chemicals. In addition, there are several applications in general industry, including, ethanol, automotive plants, and water and food processing.

Bearing Design

The chemical and abrasion resistant silicon carbide bearings are housed in a cartridge design, which is easy to mount in case of inspection or maintenance. SAFEGLIDE™ bearings can be provided for dry run protection. SAFEGLIDE™ technology has been successfully providing dry run protection for ITT products for over a decade. The cartridge design provides failure protection in case of a bearing failure by preventing the wetted rotor from contacting the containment shell. Also, abrasive bearing fragments are contained in the cartridge preventing damage to other wetted components.

Seamless Containment Shell

The containment shell is the most critical component sealing liquid from the atmosphere. The hastelloy C containment shell is deep-drawn from a homogeneous material, thus there are no welded joints exposed to the pumpage. There is a molded in breaking bead in the bottom of the can to prevent vortexing. Although the operating pressure of the pump is limited to 275 psi, the containment shell can withstand a burst pressure greater than 2,175 psig.



The 3296 EZMAG is designed for flows to 750 gpm (170 m^3/hr) and heads to 520 feet (158m) at 3500 rpm. Its operating range is between –40°F and 535°F (-40°C to 280°C), and it can handle pressures up to 275 psi . Stainless Steel is the standard material of construction. Hastelloy C and other metallurgies available upon request.

Application Flexibility

The 3296 EZMAG has several options to provide reliable pumping solutions to a wide variety of applications.

- External bearing flush for applications containing solids.
- Inducer to overcome insufficient NPSHa conditions.
- PumpSmart® flow control equipment
- Integrated connections for a variety of pump monitoring.

The 3296 EZMAG will be available for shipments in the fall.