MOYNO™

Mining & Minerals
Progressing Cavity Pumps in Mine Dewatering

OVERVIEW

Company

> Teck Highland Valley Copper (THVC)

Product

> Progressing Cavity Pumps

Application

> Mine Dewatering

Business Situation

> THVC saves maintenance and energy costs by adapting to a different dewatering system

Teck Resources, Ltd. operates the Teck Highland Valley Copper (THVC) mine located near Logan Lake, British Colombia, Canada. To facilitate efficient mine production, the Senior Foreman of Mine Services faces the challenge of continuously dewatering the surface of the largest open pit mine in North America. The traditional approach to dewatering requires a series of multiple centrifugal pumps to lift the collected water to the top of the mine for processing.

One of the original THVC dewatering system consisted of five multi-stage centrifugal pumps (four pumps at 60 HP and one pump at 25 HP), operating an average of 20 hours per day (1,364 KWH per day) to remove the collected surface water from the open pit copper mine. The surface water contains abrasive solids that accelerate wear on the centrifugal pumps requiring THVC to rebuild pumps as often as once per month and to replace pumps as much as twice each year. Every year, THVC utilized approximately $160,000 of its budget to maintain the system and consumed approximately 1,550,000 KWH of electricity to power the system. The Senior Foreman at THVC believed there was a more reliable solution to this challenge.

To improve the efficiency of the dewatering effort at THVC, the Senior Foreman selected a pump package powered by one (1) Moyno Progressing Cavity pump to replace the five (5) pump centrifugal system. In the first year of operation, the Moyno dewatering system only required scheduled inspections and periodic lubrication of the bearings. There were no parts replaced, resulting in a $160,000 reduction in maintenance costs. An additional benefit was realized as well; the Moyno system only required 358,000 KWH; an actual 77% reduction in power consumption over the submersibles or approximately $88,000 savings.

Background

Teck is Canada's largest diversified mining, mineral processing, and metallurgical company. Headquartered in Vancouver, Canada, they are a world leader in the production of copper, steelmaking coal and zinc, molybdenum and specialty metals, with interests in several oil sands development assets. Teck owns or have interests in 13 mines in Canada, United States, Chile, and Peru, as well as one metallurgical complex in Canada.

Traditional methods of dewatering in mines, especially in North America consist of using vertical turbine and/or submersible pumps with additional centrifugal pumps added for boosting purposes. While these methods get the job done, there are inherent added costs associated when sand, silt, and rocks enter the equation. These solids wear tight clearances, damage impellers, and casings of high speed impellers, reducing the efficiency and pressure capabilities of the pump.

Vertical Turbines Pumps (VTP) are designed to efficiently move large amounts of clean water at very high discharge heads. Extremely close clearances throughout the VTP are necessary to efficiently produce these high pressures. When solids/abrasives enter into the VTPs, typical of dewatering applications, the internal clearances quickly become worn and the efficiency and performance of the VTPs rapidly degrade.

The open-pit, Teck Highland Valley Copper Mine utilizes the standard centrifugal pump dewatering methodology that is common across the North American mining industry. THVC were challenged with a surface water build up of approximately 360,000 gallons of water each day on a particular bench, approximately 600 feet below the top of their pit. THVC needed to pump 600 gallons per minute from this bench to the top of the pit for reprocessing. The original dewatering system was designed around VTPs and submersible pumps, staged at progressive levels in the mine to relay the surface water to the top of the pit. This complex system required a total combined horsepower of 265 horsepower, operating an average of 20 hours each day.

The Senior Foreman at THVC determined that as the VTPs and the submersible pumps operated for 6 weeks, their flow reduced from 600 gpm to 300 gpm. THVC would remove these pumps from service, rebuild and re-install it to return the pump to design conditions. THVC would rebuild each pump twice, and then it would replace the pump due to excessive casing and bowl wear. The maintenance budget to maintain this single 5 pump system was approximately $160,000 to supply parts and new pumps. The labor was an additional expense for the maintenance of this system.

Initiative

The Teck HVC Team approached this application with professional scrutiny to ensure confidence in using one pump to transfer so much water at high discharge pressure. Surprisingly, many engineers and mine foreman in North America are unfamiliar with reliability and cost benefits of progressive cavity pumps. Mining operations United Kingdom, Europe, Australia, Asia and Africa have been using PC pump technology for dewatering for decades. Progressive Cavity pumps are a perfect fit for dewatering applications due to the high reliability and operating life since they operate at a slow speed reducing wear caused by abrasive particles and their ability to handle solids in the fluid. This application of PC pump technology at Teck demonstrated the equipment's reliability difference between the 3600 rpm centrifugal pumps and the 450 rpm PC pump. PC pumps are positive displacement so they continuously generate discharge pressure at various flow rates, regardless of pump speed.

Once commissioned, the Moyno system performed better than expectations. Rather than monthly maintenance and replacement performed on the old centrifugal pumps, the PC pumps continued to operate reliably and cost effectively. The pumps continue to run successfully after more than 18 months of continuous service.

Conclusion

THVC's Senior Foreman knew he was on the right track when the Teck Management asked how the maintenance budget was under-spent by an average of $15,000 per month. After explaining that the maintenance budget for the dewatering system was now negligible, the Senior Foreman was encouraged to use this "new" Moyno Progressing Cavity technology in new applications throughout the operation. Teck Highland Valley Copper's Chief Executive Officer recognized the Senior Foreman for his innovative vision and creative problem solving.

Scenario Calculation: 360,000 US gallons per day at 600 feet lift

	HP	Voltage	Amps	Sqrt. of 3	PF	Run Hr./Day	kWh/Day	kWh/Year	0.0736*	Qty.	Cost
Centrifugal	25	575	23.2	1.732	0.87	20	402	146,739	10,800.00	1	$10,800.00
Centrifugal	60	575	56.8	1.732	0.85	20	962	350,999	25,833.52	4	$103,334.10

CENTRIFUGAL PUMP TOTAL COST $114,134

	HP	Voltage	Amps	Sqrt. of 3	PF	Run Hr./Day	kWh/Day	kWh/Year	0.0736*	Qty.	Cost
PC Pump	125	575	114.4	1.732	0.86	10	980	357,629	26,321.52	1	$26,321.52

PC PUMP TOTAL COST $26,321

*Energy charge of $0.07360 per kWh (BC Hydro transmission rates as published online)

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